

CHAPTER 7

CONSOLIDATION AND UNITIZATION FOR SHIPMENT AND USE OF CARGO CONTAINERS

7-1. Consolidation and Unitization for Shipment

Consolidation is the bringing together of like or unlike items for shipment. Once the items are assembled, they must be kept together as a single unit until they reach a break-bulk point or the ultimate consignee. Unitization results in econ-

omy through reduction in handling and documentation, one unit taking the place of several units.

a. *Advantages.* Figure 7-1 gives advantages of unitizing loads which are as follows:

(1) Eliminates laborious and expensive manual handling of individual items.

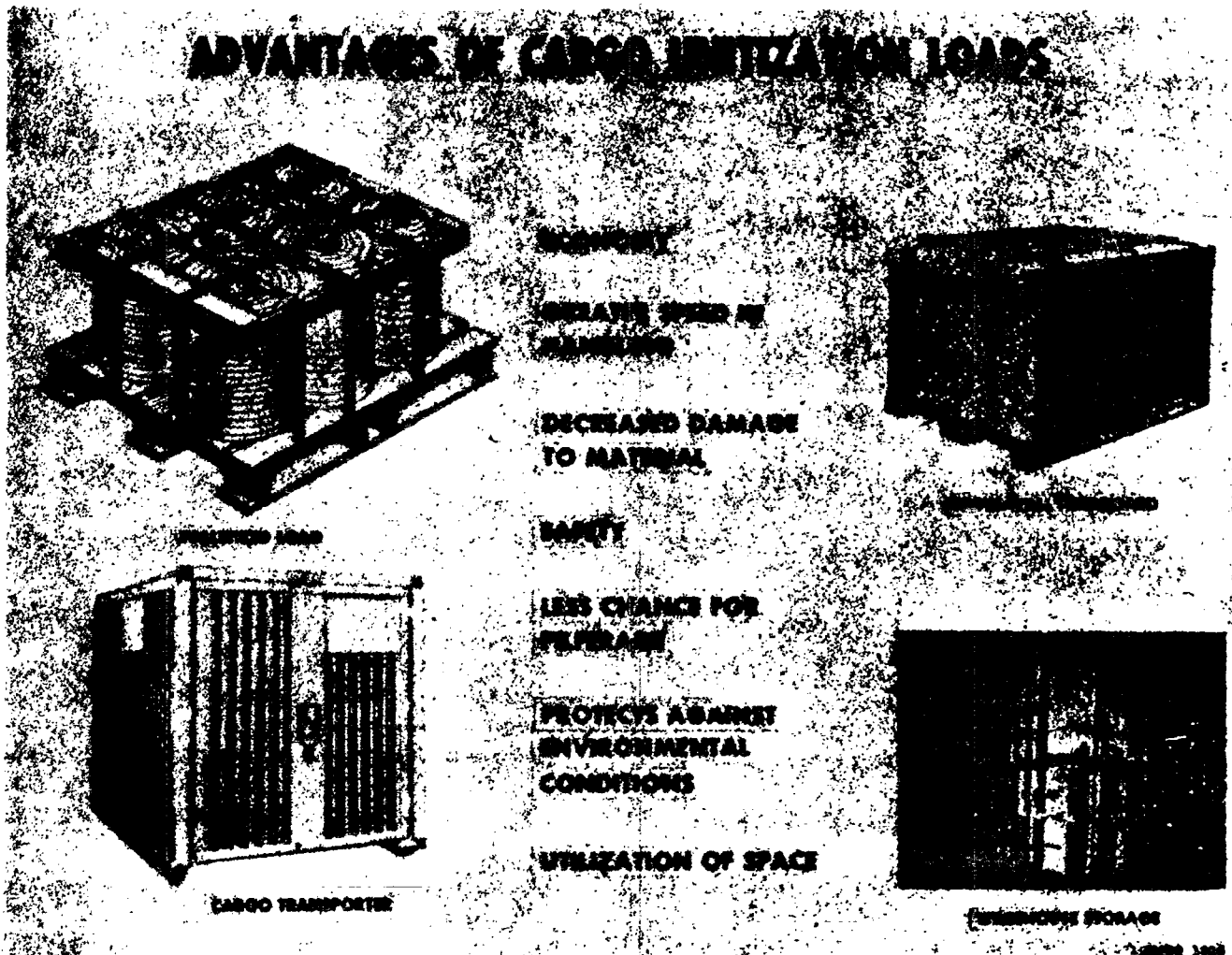


Figure 7-1. Advantages of cargo unitization.

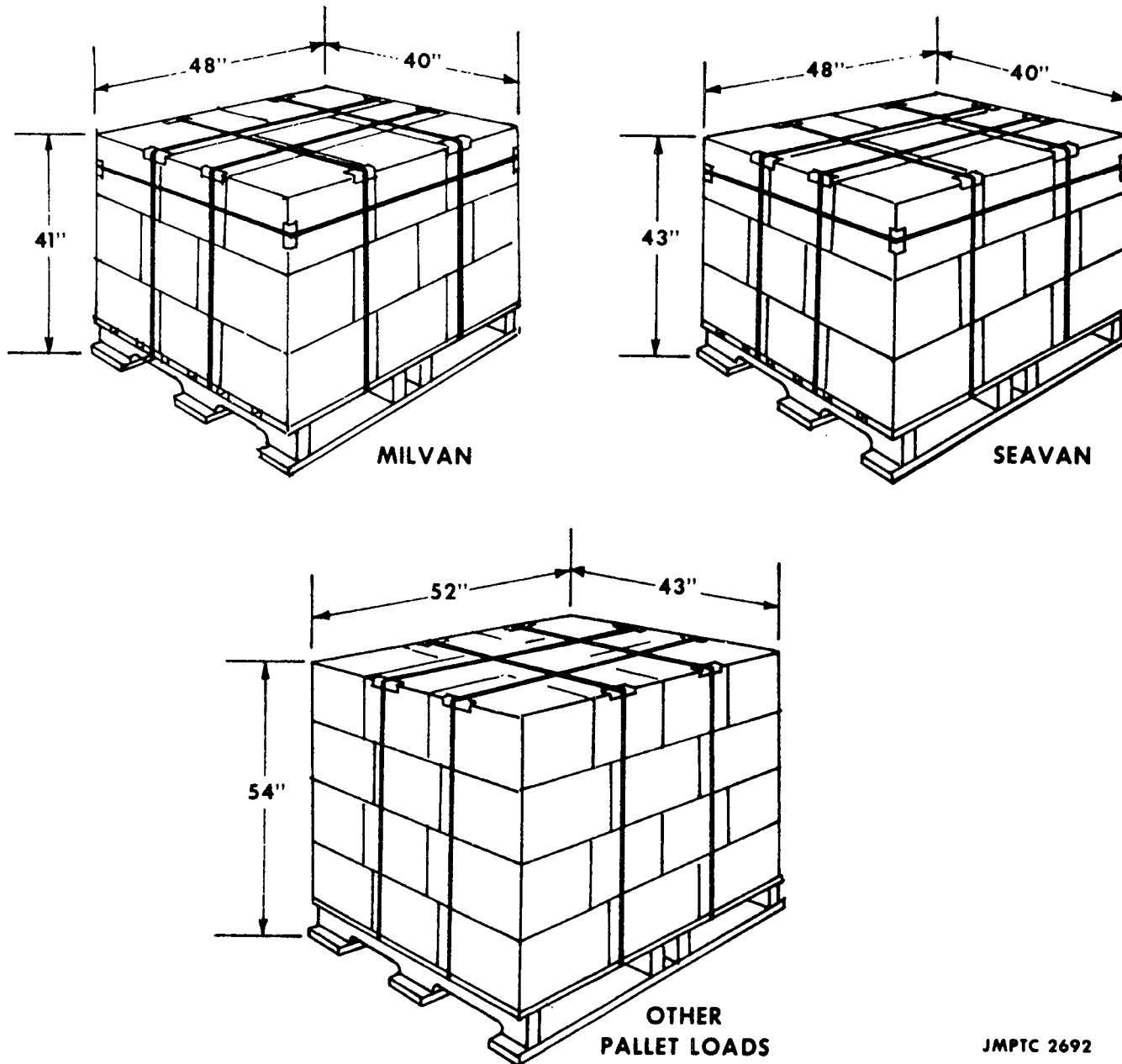


Figure 7-2. Pallet size limitations.

(2) Reduces damage to items by eliminating manual handling.

(3) Permits savings in handling costs.

(4) Reduces personnel accidents by eliminating manual handling and lifting.

(5) Simplifies inventorying and reduces inaccuracies.

(6) Utilizes storage heights not possible by manual means.

(7) Reduces pilferage because of unitization of items by steel straps and other bonding methods.

(8) Permits faster movement of supplies and equipment and provides greater utilization of carrier equipment.

(9) Reduces marking requirements on individual containers.

b. Forms of Unitization. The two basic forms of unitization are—

(1) *Palletization.* This is the placing of a number of packages on a low, portable platform of wood, metal, or fiberboard, or a combination of these materials.

(2) *Containerization.* This is the placing of a number of packages into a container, which not only reduces the number of units and documentation, but provides additional protection to the packages.

7-2. Palletizing Unit Loads (MIL-STD-147)

Military Standard MIL-STD-147 gives the palletized unit load requirements for Department of Defense material using the pallets discussed in paragraphs 3-10 and 3-11. The standard establishes loading patterns for various types of commodities, listing the pattern for stacking containers and the methods of unitizing to be used.

a. Limitations. The following size and weight limitations apply to the complete load including the pallet and the bonding and storage aids (fig 7-2).

(1) Unless otherwise specified by the procuring activity, load units prepared for shipment in MILVANS and SEAVANS shall not exceed 40 inches in length. All other loads shall not exceed 43 inches in length, which permits an overhang of 1½ inches at each end of the pallet.

(2) Unless otherwise specified by the procuring activity, load units prepared for shipment in MILVANS and SEAVANS shall not exceed 48 inches in width. All other loads shall not exceed 52 inches in width, which permits an overhang of 2 inches at each side of the pallet.

(3) Load units prepared for shipment in containerization media such as SEAVANS, etc. shall not exceed 43 inches in height and in MILVANS, 41 inches. All other loads shall not exceed 54 inches in height, except as permitted for loads of compressed gases in cylinders.

(4) The maximum gross weight of a load shall not exceed 3,000 pounds per single pallet load for domestic, intercoastal, or oversea shipments.

b. Types of Palletized Loads. Types of supplies that can be palletized are

(1) Items which are identical and identified by the same stock number.

(2) Items uneconomical or impractical to pack otherwise.

(3) Rugged and durable items that require minimum physical protection.

(4) Boxed items uniform in size requiring additional protection.

(5) Items that are moved in large quantities.

c. Load Arrangement. The arrangement of items to the pallet must provide a rigid, compact, uni-

form size load, strongly secured to prevent shifting, and capable of resisting impact, vibration, racking, and compression encountered during handling, storage, and shipment. Basic principles for arranging and securing loads to pallets are—

(1) Items should be interlocked, nested, or bundled whenever possible.

(2) The load pattern should eliminate or reduce void space.

(3) Wood separators or spacers are placed in voids between rows and layers of irregular-shaped items to insure a firm and stable load.

(4) The top surface of the loading pallet must be level, or made level for stacking purposes. This can be accomplished by applying a wood top frame or leveling boards with a supporting framework.

(5) Loads difficult to stabilize or which are compressible and not sufficiently firm to support superimposed loads, will be reinforced with a supporting framework as prescribed in (4) above.

(6) Boxed items are arranged on the pallet so that the markings on individual containers do not show on two adjacent sides of the palletized load. This will provide clear areas for unit load marking.

(7) The load is secured to the pallet, using the applicable size of strapping given in table 7-1 for applying lengthwise and crosswise strapping. Horizontal strapping is the same size as the tie-down strap size. The gross weight of the load, divided by the total number of tie-down straps to be used, determines the weight which must be borne by each strap. This weight is compared with the strap capacity listed in table 7-1. The strapping which has the same or next higher capacity is used. Non-metallic strapping is not authorized for the strapping of palletized loads of wooden, plywood, or metal shipping containers.

(8) Strapping is applied in a manner that will eliminate any possibility of slippage. Wood cleats, tie blocks, or braces are used under straps when necessary to insure stability or to bridge unsupported spans.

d. Loading. To properly load a pallet, consideration must be given to the type of item, its weight, and destination. It is recommended that Military Standard MIL-STD-147 be followed when loading 40- x 48-inch pallets. Figure 7-3 illustrates one common type of palletized load out of the many types illustrated in the standard.

7-3. Shrink Film Palletization

Plastic films such as polyethylene are now being used in accordance with the requirements of

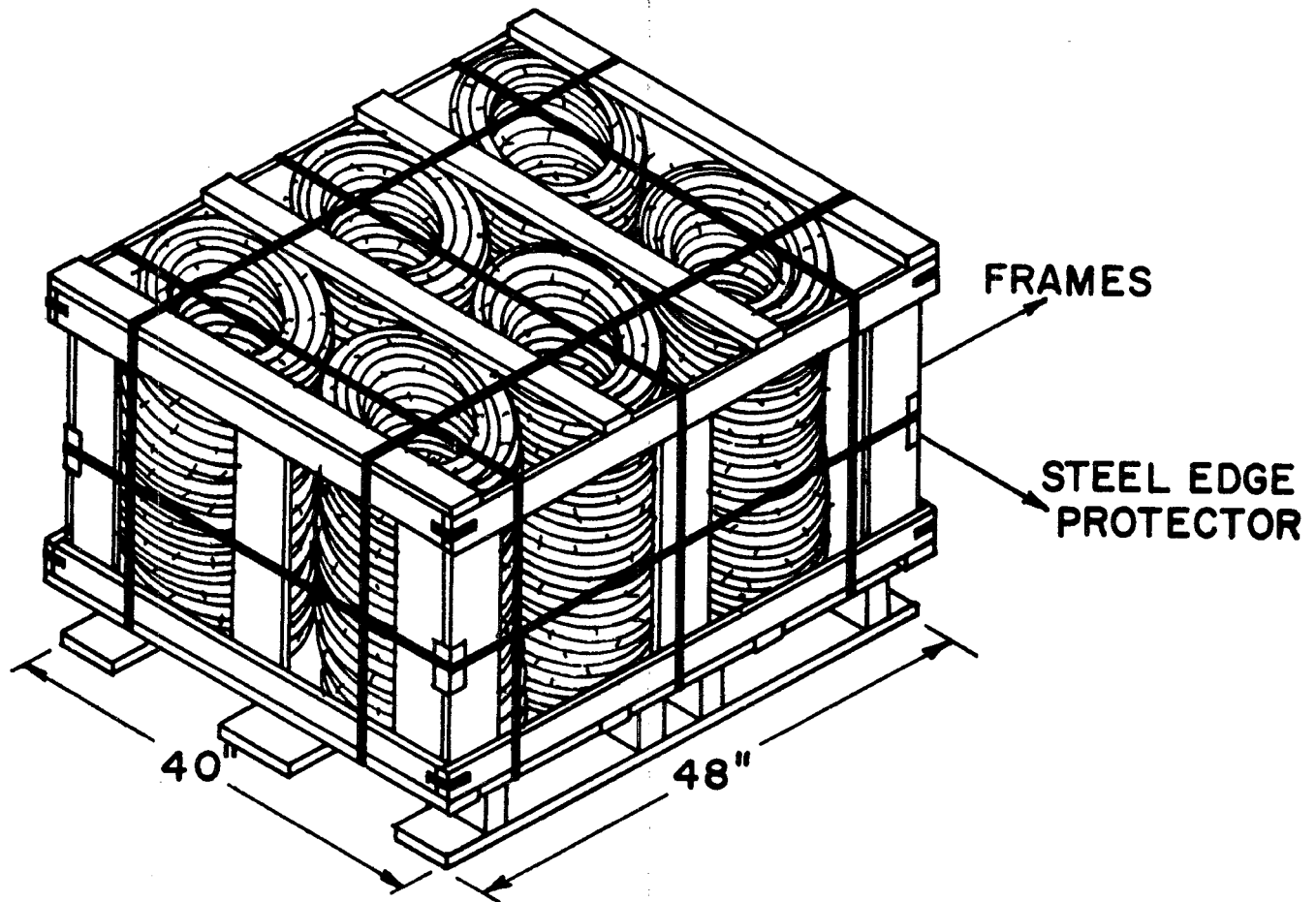
Table 7-1. Maximum Safe Working Capacities of Steel and Nonmetallic Strapping (para 7-2c(7))
Metal Strapping QQ-S-781

Flat Strapping			Round Strapping	
Nominal width and thickness Inch Size	Standard (Cold rolled)	High Tension Hot rolled (HR) Cold rolled (CR)	Wire Size	Safe Capacity Maximum per strand
(inches)	(pounds)	(pounds)	(gage)	(pounds)
3/8 x 0.015	112			
3/8 x 0.020	150			
3/8 x 0.23	150			
1/2 x 0.15	150			
1/2 x .020	200		16	107
5/8 x .020	250		15	140
5/8 x .023	300		14	175
3/4 x .023	350		13-1/2	200
3/4 x .025		575 (CR)	13	230
3/4 x .028	450	575 (HR)	12-1/2	265
3/4 x .031		725 (CR)	12	300
3/4 x .035	525	725 (HR)	11	375
1-1/4 x .031		900 (CR)	10	500
1-1/4 x .035		900 (HR)	9	600
1-1/4 x .044		1275 (CR)	8	720
1-1/4 x .050		1275 (HR)		
1-1/4 x .065		1700 (HR)		
2 x .044		2000 (CR)		
2 x .050		2000 (HR)		
2 x .065	2625 (HR)			

Nonmetallic Strapping PPP-S-760
Type II

Nominal width and thickness	
Inch Size	Safe Capacity Maximum per strap
(inches)	(pounds)
1/4 x 0.015	75
1/4 x .020	100
1/4 x .025	125
3/8 x .015	112
3/8 x .020	150
1/2 x .0125	120
1/2 x .015	150
1/2 x .020	200
1/2 x .025	250
1/2 x .030	300
5/8 x .015	190
5/8 x .020	250
5/8 x .025	310
5/8 x .030	375
1-1/4 x .035	900

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Figure 7-3. Example of palletized load.

MIL-STD-147 as a means of bonding palletized loads. The plastic film is stretched in the manufacturing process; this is called "orientation." The stretched film shrinks when subjected to a controlled flow of heated air. The heated air is supplied by the use of a heat shrink cannon (fig 7-4) or a shrink film chamber (fig 7-5). The heat causes the film to shrink, conforming to the contour of the load. For this reason, it can be used for pallet loads containing a variety of items which form irregular shaped configurations that could not be palletized by conventional means. The tightly adhering film immobilizes the contents and provides stability. It also provides some weather protection for exposed cargo. Shrink film palletization provides a reduction of labor and material cost by the use of automatic equipment and eliminates the problem of damage caused by too tight strapping of containers.

7-4. Consolidation Containers (General)

Consolidation containers may be constructed of fiberboard, paper-overlaid veneer, plywood, or lumber. They may be demountable or non-demountable. They are usually secured to a pallet base or a skid base for handling purposes. Some containers are intended to be expendable, while others are intended to be reusable. Some consolidation containers are designed to be compatible with the requirements of the 463L Materials Handling System of the Air Force. Others are designed to be used as inserts in transporters such as CONEXES, MILVANS, or SEAVANS, or to be used as separate shipping containers.

7-5. Expendable Fiberboard Pallet Boxes (MIL-P-26342)

Military Specification MIL-P-26342 covers the re-

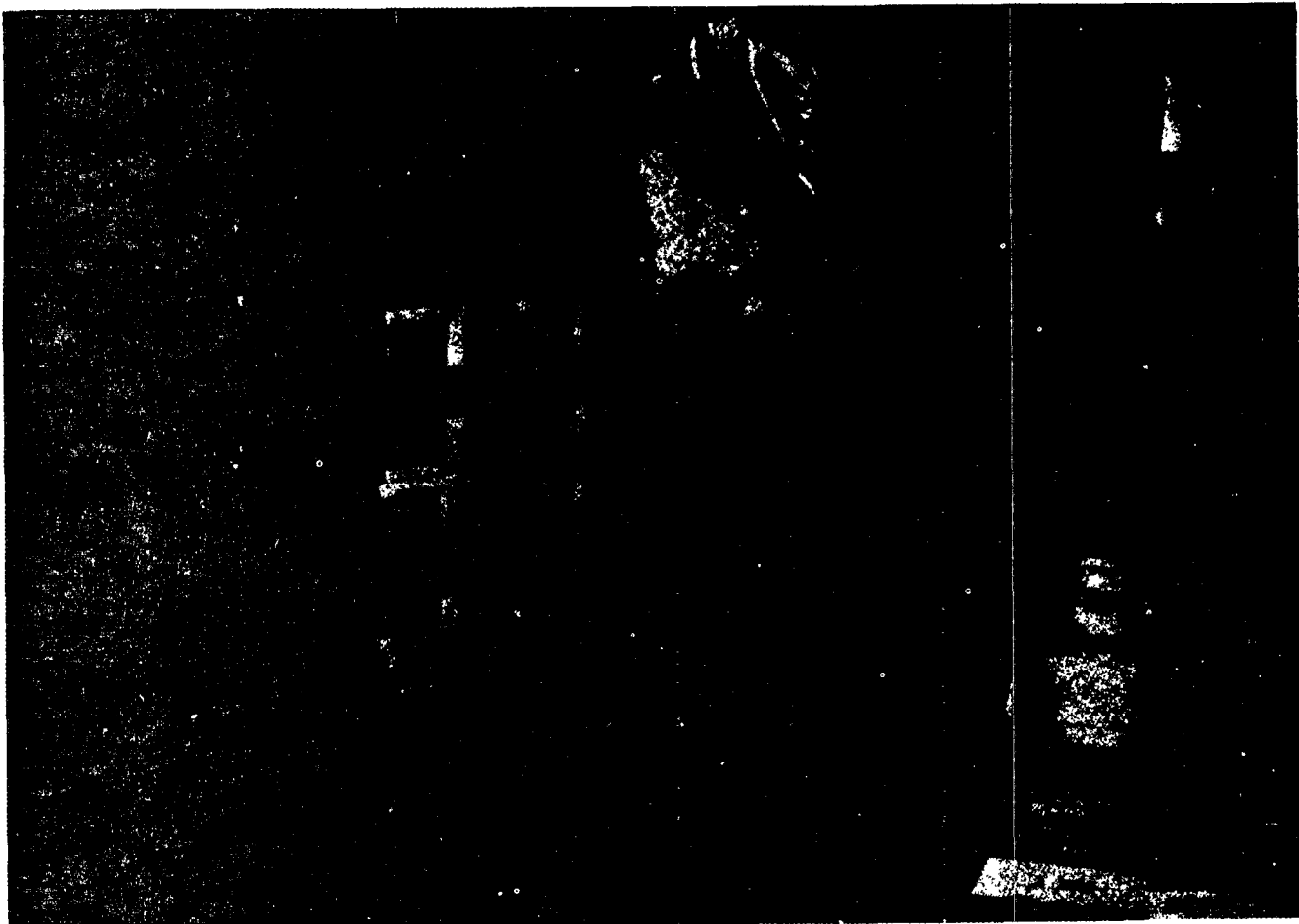


Figure 7-4. Use of cannon to heat shrink film around palletized load.

quirements for fabricating two classes of expendable fiberboard pallet boxes (fig 7-6).

a. Classification. These containers are classified as either domestic or weather-resistant.

b. Description. These containers are fabricated from fiberboard and consist of a pallet base, bottom tray with drainage holes, body, and top cap. The weather-resistant class of boxes has an auxiliary tray which fits inside and at the bottom of the box. This auxiliary tray may be specified for the domestic class also, when necessary. An interlocking top cap (fig 2-9) may be specified for either class of box, when necessary. Dividing inserts may also be specified for either class of box. Table 7-2 lists the size designations and applicable dimensions together with the weight capacities applicable to each size box. See table 7-3 for the number of inserts required for each size box.

c. Closure and Strapping Requirements.

(1) After the boxes are packed and closed, they are strapped with nailless flat steel strapping with formed edges conforming to Specification QQ-S-781. The minimum size should be $\frac{3}{4}$ x 0.015 inches with a minimum tensile strength of 80,000 psi.

Table 7-2. Size Designations, Dimensions, and Load Limitations (MIL-P-26342)

Size designation	Dimensions (inches)			Maximum load (lb)
	Length	Width	Depth	
A1	35	35	12	500
A2	35	35	24	500
A3	35	35	36	500
B1	40	48	12	800
B2	40	48	24	800
B3	40	48	36	800

Table 7-3. Number of Dividing Inserts Required for Each Size Designation of Expendable Fiberboard Pallet Box (MIL-P-26342)

Size designation	Length of insert (inches)		
	35	40	48
A1	5		
A3	10		
A3	15		
B1		3	2
B2		6	4
B3		9	6

Note 1. An insert is the single sheet of fiberboard cut to the interior dimension of either the width or length of the box, and notched to permit matching with other inserts running in a perpendicular direction.

Note 2. The lengths 35", 40", and 48" indicate the outside dimension of the box in which the insert is to be used, modified to allow for the thickness of the fiberboard utilized in manufacturing the box.

(2) Two girthwise straps shall be applied to sizes A-1, A-2, and A-3. The straps shall be perpendicular to each other on the top and bottom and placed approximately 1/2-inch from one edge of the center row of posts (fig 7-7).

(3) Three girthwise straps shall be applied to sizes B-1, B-2, and B-3. Two straps shall go around the top, sides, and bottom at the center of the forklift finger areas and one strap shall go around the top, ends, and bottom. This one strap shall be placed approximately 1/2 inch from one edge of the center row of post (fig 7-7).

(4) Straps shall be applied straight and sufficiently tensioned to imbed into the edges of the pallet box, but not to the extent of cutting, tear-

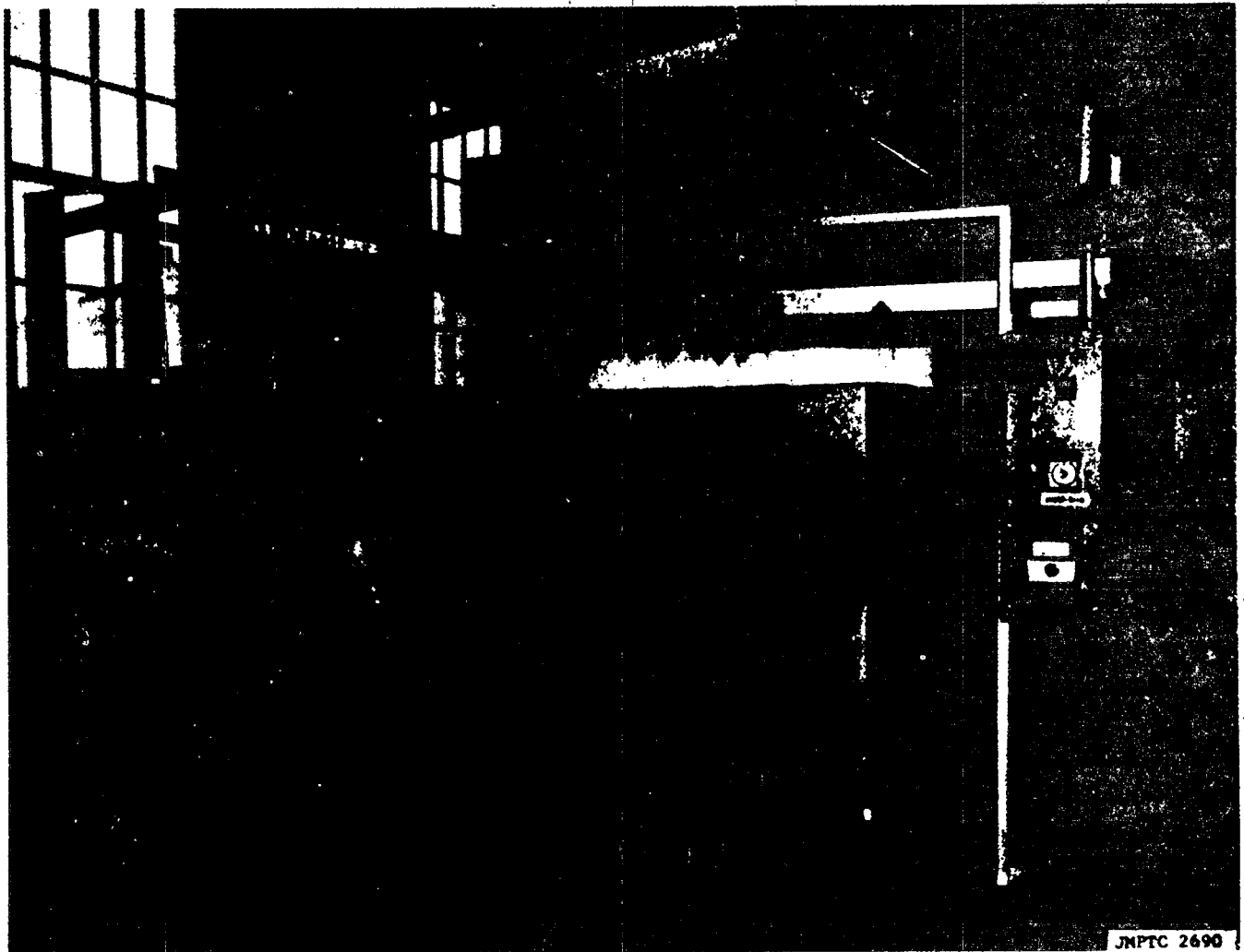


Figure 7-5. Shrink film chamber used for heat shrinking film around palletized load.

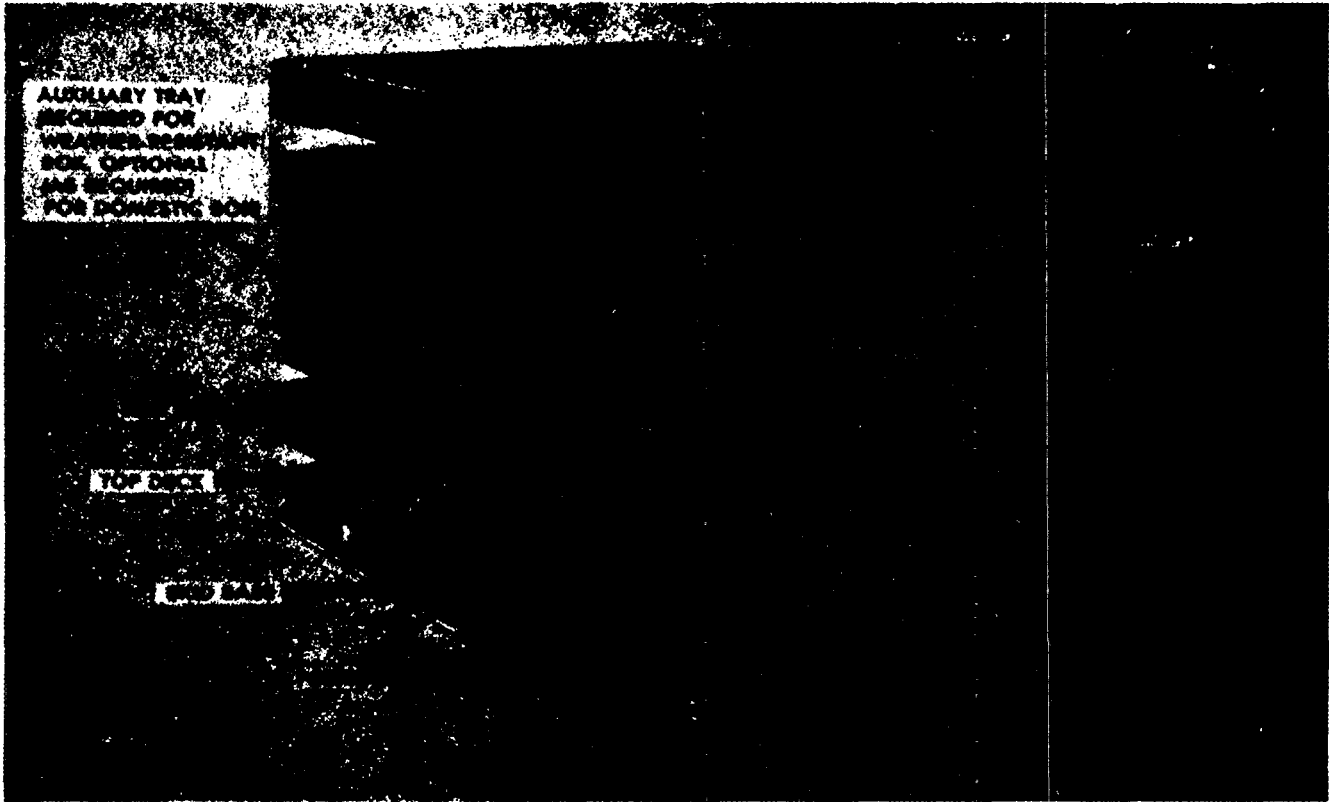


Figure 7-6. Expendable fiberboard pallet box (MIL-P-26342).

ing, or otherwise damaging the fiberboard or crushing the contents. Exposed ends of strapping shall not be of a hazardous length.

7-6. Fiberboard Consolidation Containers (MIL-B-38721) (USAF)

Military Specification MIL-B-38721 (USAF) covers fabrication requirements for weather-resistant, high stacking strength, double-wall and triple-wall corrugated fiberboard boxes (fig 7-8).

a. Selection and Use. These boxes are intended for domestic and overseas consolidation shipments of aircraft parts and general supplies and equipment. They were designed as a standard system of fiberboard containers to meet the requirements of the 463L Materials-Handling Support System of the United States Air Force.

b. Classification. These containers have been classified into two types and two styles (fig 7-8).

- Type I. Double-wall corrugated fiberboard
- Type II. Triple-wall corrugated fiberboard

- Style S. A three-piece box consisting of a sleeve (tube body) with top and bottom covers
- Style T. A two-piece box consisting of a half-slotted container body with a cover

c. Size Limitations. The size designations, together with the types and styles to which they pertain, and the dimensions of the boxes are included in table 7-4.

Table 7-4. Fiberboard consolidation box sizes (MIL-B-38721)

Size designation	Applicable to		Inside dimensions (inches)		
	Type	Style	L	W	D
Sixteenth -----	I	S	23	x 18-1/8	x 15
Eighth -----	I	S	23	x 18-1/2	x 29
	II	S	22-1/2	x 18	x 28-1/2
Quarter -----	I	S	40	x 23	x 29
	II	S	39-1/2	x 22	x 28-1/2
Half -----	II	S&T	47-1/2	x 22-1/2	x 28
Full -----	II	T	83	x 39-1/2	x 28
				x 49	

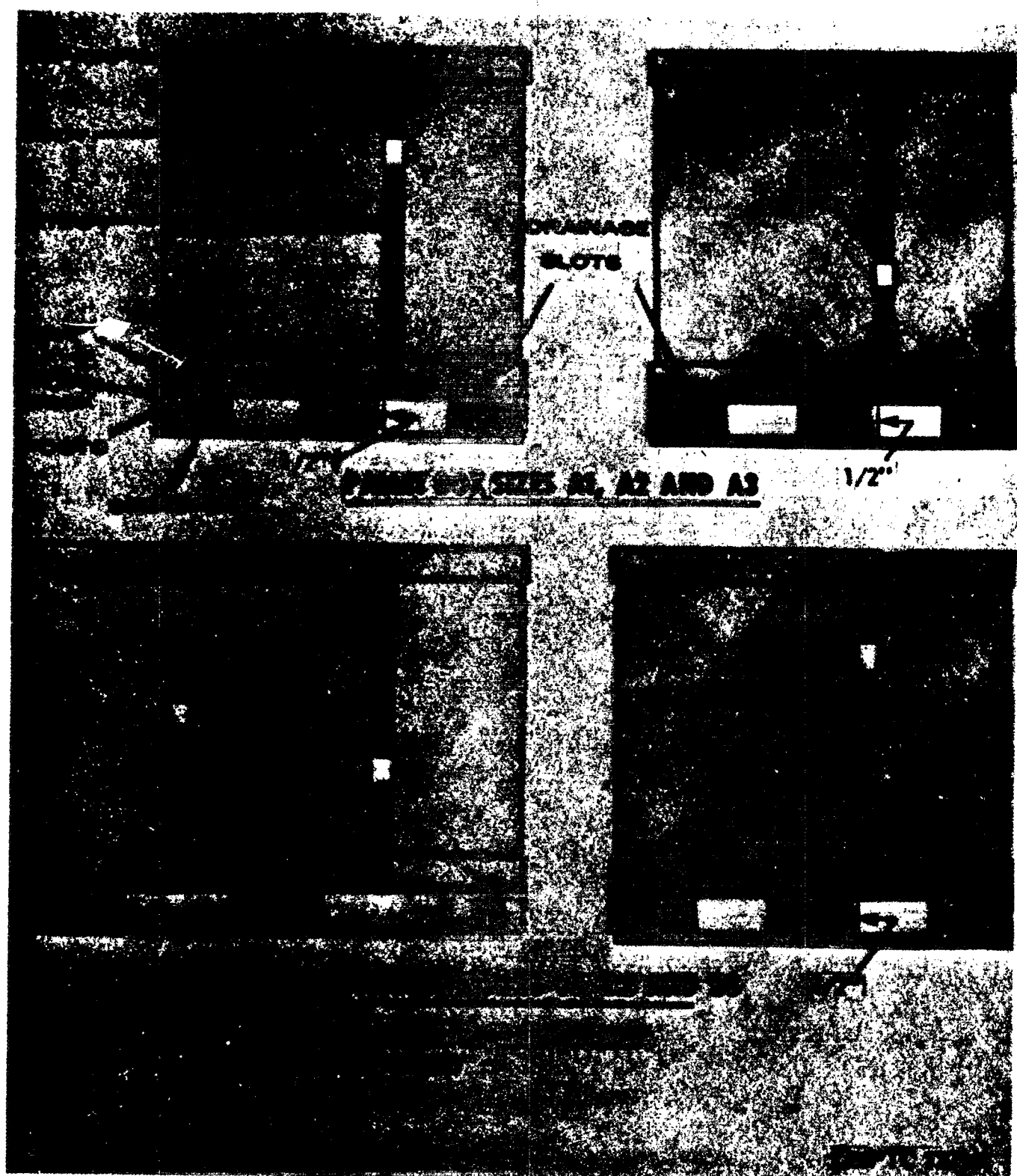


Figure 7-7. Strapping of expendable fiberboard pallet boxes (MIL-P-26342).

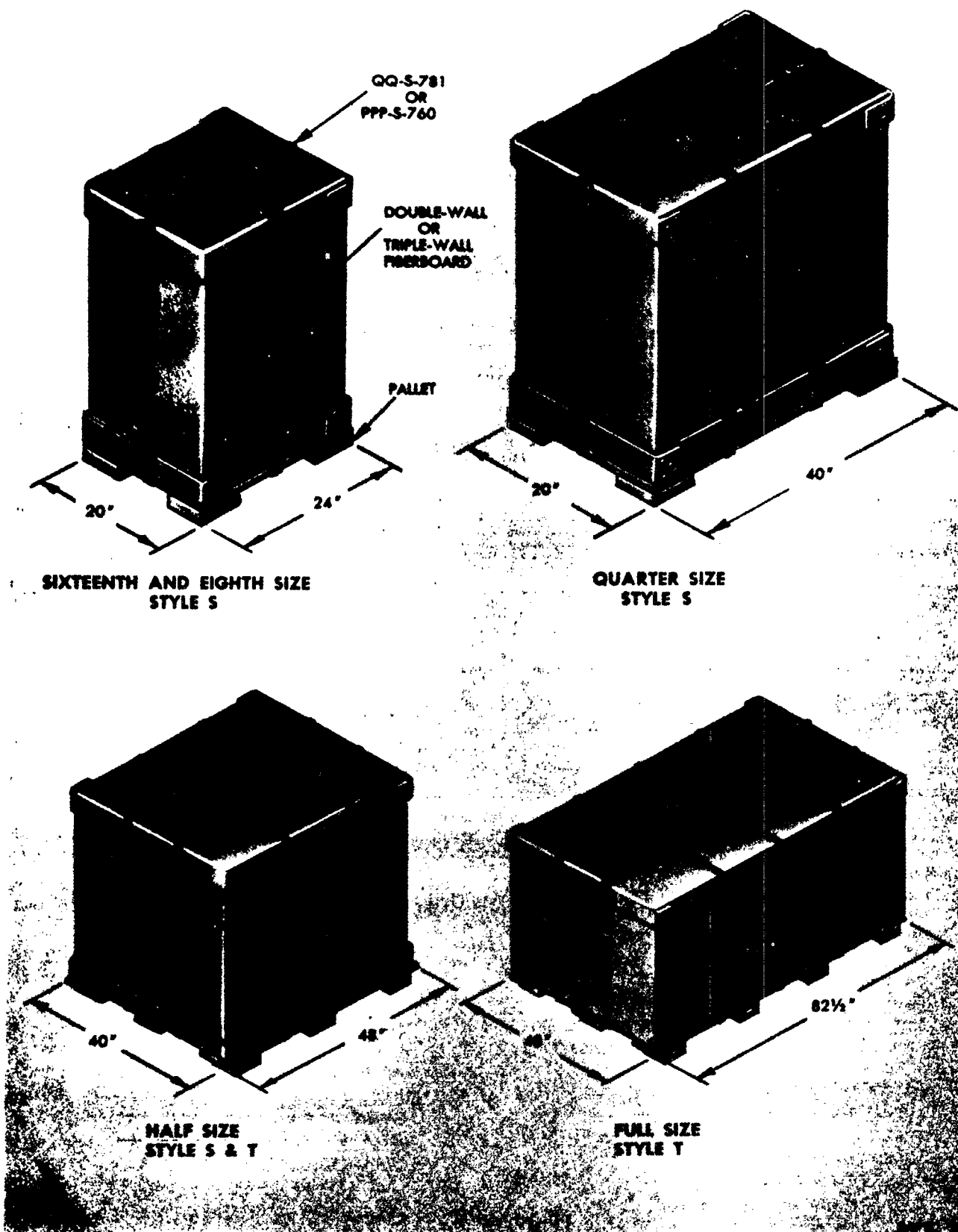


Figure 7-8. Box, consolidation, fiberboard (MIL-B-38721).

d. Strapping Requirements. After the containers have been assembled and packed, they shall be strapped with $\frac{3}{8}$ -inch wide steel straps having a minimum thickness of 0.020 inches and conforming to Specification QQ-S-781, or with nonmetallic straps conforming to Specification PPP-S-760 of comparable tensile strength. Lengthwise straps shall first be applied, then girthwise straps (fig 7-8).

(1) Sixteenth and eighth size containers require one lengthwise and one girthwise strap.

(2) Quarter size containers require one lengthwise strap located in the center of the container, and two girthwise straps spaced one-third the distance between the ends of the container.

(3) Half size containers require two lengthwise straps spaced one-third the distance between the ends of the container and two girthwise straps.

(4) Full size containers require two lengthwise straps spaced approximately one-third the distance of the container width dimension, and three girthwise straps—one spaced approximately 18 inches in from each end and one in the center of the container.

7-7. Boxes, Shipping Insert Consolidation, MIL-B-43666 (General)

a. Description. These boxes are constructed of wood cleated plywood, plywood wirebound, double-wall fiberboard, or triple-wall fiberboard. They are mounted on pallet-type bases for ease of handling. Their construction varies widely depending upon the materials used. The sizes are such that they are modular in concept.

b. General Use. These boxes are intended for use as inserts in cargo transporters such as CONEX, MILVANS, or Seavans, or as separate exterior containers. They are to be used for Level A or B shipments.

c. Classification. There are three types of consolidation insert containers. Type I is of wood cleated plywood construction and has two styles depending upon the style of pallet base used. Type II is of plywood wirebound construction and has two styles depending upon the construction of the pallet base. Type III is constructed of double-wall or triple-wall fiberboard. Type III has four styles depending upon the construction features of the box.

d. Marking. The marking for shipment will be in accordance with MIL-STD-129.

7-8. Type I, Wood Cleated Plywood Consolidation Insert Box (MIL-B-43666)

a. Description. These containers are wood cleated plywood boxes similar in construction to the PPP-B-601 cleated plywood boxes. They are provided with a four-way entry pallet base (fig 7-9).

b. Use. These boxes may carry Type 1, 2, or 3 loads not exceeding a density of 37 pounds per cubic foot. Loads exceeding this density require additional box reinforcement. They may be used for domestic and oversea shipments. They are intended for consolidation of like and unlike stock numbered items. These containers may be used as inserts in SEAVANS or MILVANS, but should not be used as inserts in CONEX transporters.

c. Size and Weight Limitations. There are 21 sizes available in the wood cleated plywood consolidation insert containers. The outside length ranges from 30 to 88 inches. The outside width ranges from $31\frac{3}{4}$ to 45 inches. The outside height ranges from $21\frac{1}{2}$ to $52\frac{1}{2}$ inches. For MILVAN shipments, the overall height shall be not more than $41\frac{1}{2}$ inches. The weight capacity for the various sizes ranges from 1,000 to 2,600 pounds. Table I and II of MIL-B-43666 specifies the length, width, height, and weight combinations for each of the 22 sizes.

d. Closure. Nail the top to the sides using six-penny cement-coated, chemically etched, or mechanically deformed nails spaced three inches apart. Do not drive the nails into the end grain of the vertical cleats.

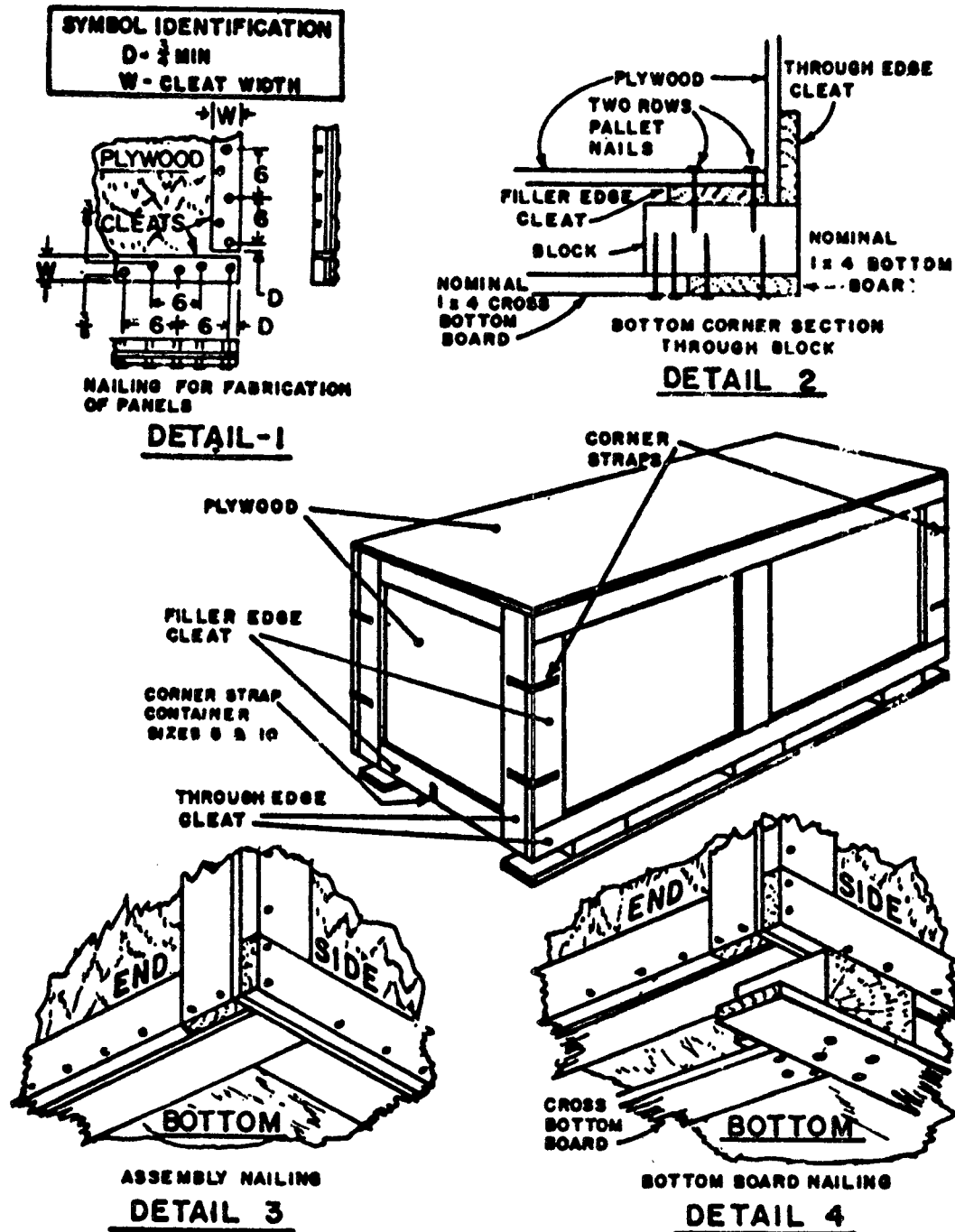
e. Strapping Requirements.

(1) Each vertical corner shall be reinforced with $\frac{3}{4}$ -inch flat steel strapping 0.023 inches thick.

(2) The strapping will be attached to the cleats with pneumatically driven galvanized staples $\frac{7}{16}$ inches long or with 1-inch long nails pneumatically driven.

(3) As an alternate, $\frac{3}{4}$ -inch wide flat, nail-on strapping, 0.025 or 0.028-inch in thickness, may be used. This strapping, which is perforated with holes spaced $\frac{1}{2}$ to $1\frac{3}{4}$ inches apart, may be secured with large headed galvanized roofing nails, zinc coated steel roofing nails, or 1-inch mechanically driven nails.

(4) Each strap will be secured with four fasteners. Two will be driven into the through cleat on the end of the box and two will be driven into the filler cleat on the side of the box.



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Figure 7-9. Type 1, style 1, wood cleated plywood consolidation box (MIL-B-43666).

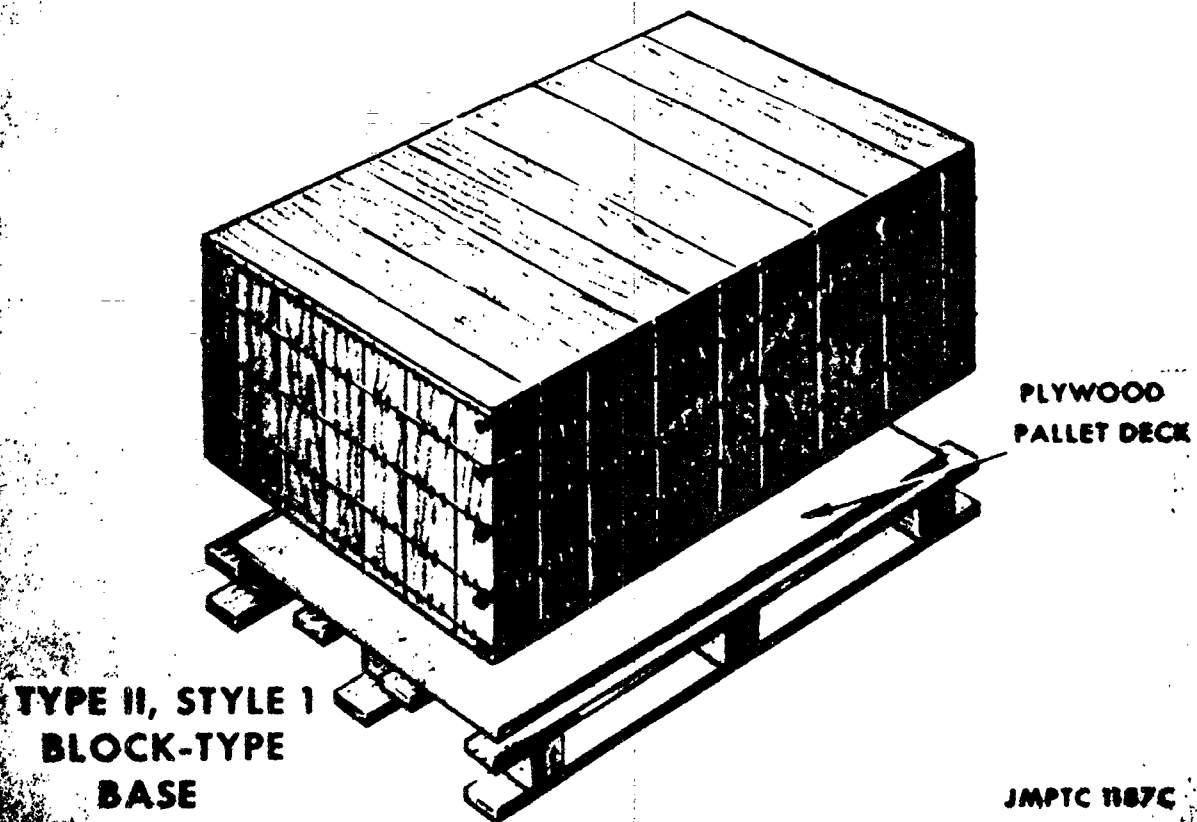
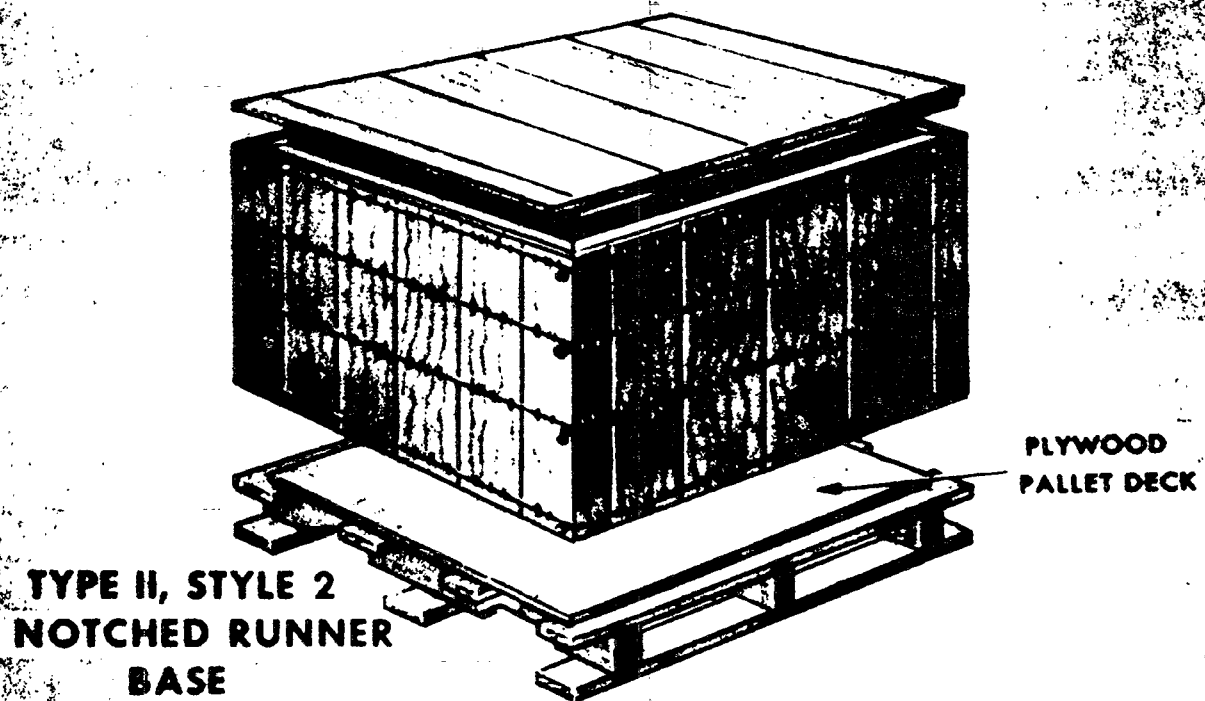


Figure 7-10. Type II, plywood wirebound consolidation boxes (MIL-B-43666).

(5) On boxes 43 inches high, strapping will be placed 13 and 26 inches from the top of the box.

(6) On boxes 21½ inches high, strapping will be placed 2 and 15 inches from the top of the box.

(7) On box sizes 5 and 10, which are 44 inches wide, an additional strap shall be placed at the center of each corner formed by the bottom and end panels.

7-9. Type II, Plywood Wirebound

Consolidation Insert Box (MIL-B-43666)

a. Description. The body and top of these boxes are constructed of plywood panels bound together with binding wires. The bottom panel is fabricated from ½-inch plywood which is secured to either a skid base or a pallet base (fig 7-10).

b. Use. The use of Type II plywood wirebound boxes is the same as Type I wood cleated plywood boxes.

c. Classification. There are two styles of boxes available under the Type II classification.

(1) Style 1 box utilizes a double-wing, block-type pallet base (fig 7-10).

(2) Style 2 box utilizes a skid base having three lengthwise skids which are cut out to facilitate side entry by forklift trucks.

d. Size and weight limitations. There are several sizes available in the plywood wirebound consolidation containers. The range of outside dimensions and weight limitations are approximately the same as those specified for the Type I, cleated plywood boxes. Tables I, and II, of MIL-B-43666 specify the length, width, and height combinations for each of the sizes.

e. Closure. After the box body is assembled by securing the wire loops with a sallee closure hand tool, or similar suitable alternate tool, and nailed to the base, make the closure by nailing the plywood top to the top cleats with threepenny nails. Space the nails 4½ inches apart. Complete the closure by applying lengthwise and girthwise straps.

f. Strapping Requirements. Requirements for the size, number, and location of straps vary for each style and size of Type II containers. Consult the Appendix of MIL-B-43666 for detailed requirements for reinforcing the particular plywood wirebound container being used.

7-10. Type III, Fiberboard Consolidation Insert Box (MIL-B-43666)

a. Description. These boxes are made of double-wall or triple-wall fiberboard. The box design and

construction differs for each of the four designated styles. Unless otherwise specified, they are furnished with a pallet base.

b. Use. Type III fiberboard insert boxes should be restricted to CONEX, MILVAN, or SEAVAN when used for level A oversea shipments. They may be used as shipping containers for Level B oversea shipments and as domestic consolidation containers. Type III boxes are intended to carry Type 1, 2, and 3 loads not exceeding a density of 37 pounds per cubic foot. Loads exceeding this density require additional box reinforcement. Style 1 should be used for items of assorted stock numbers to be loaded at origin as inserts only for shipment in CONEX, MILVAN, and SEAVAN to a single consignee address code.

c. Classification. There are four styles of boxes available under Type III classification.

(1) Style 3, regular slotted box (RSC), is similar to the regular slotted container available under the PPP-B-636 fiberboard box specification, except that one outer flap slightly overlaps the other (fig 7-11). The box may be furnished with or without a pallet base. When a pallet base is used, it may be either a double wing block-type or double wing notched runner-type.

(2) Style 4 half slotted container (HSC) with telescoping sleeve and cap, consists of a half slotted container bottom section without top flaps, and a top cap which extends down six inches over the sleeve (fig 7-11). The requirements for the pallet base are the same as for Style 1.

(3) Style 5 flanged bottom tube with cap, pad, and pallet, consists of a fiberboard tube with 4-inch bottom flanges, a bottom pad, and a top cap which fits down over the body tube (fig 7-12). This style is furnished with a stringer type pallet base.

(4) Style 6, half slotted container (HSC) with cap and pallet base, consists of a body having a regular slotted bottom and a flanged top, a top pad, and a top cap (fig 7-12). Unless otherwise specified, it is furnished with a pallet base.

d. Size and weight limitations. There are several sizes available in the fiberboard consolidation containers, depending upon the styles. The outside length ranges from 30 to 88 inches. The outside width ranges from 31¾ to 45 inches. The outside height ranges from 21½ to 52½ inches. The weight limit ranges from 1,000 to 2,600 pounds. Style 3 is available in sizes 1 through 10; Style 4 is available in sizes 23 and 24; Style 5 is available in sizes 16, 17, 18, and 24; and Style 6 is available in sizes 14 and 15. Tables I and II of MIL-B-43666 must be consulted for the various length, width, height, and weight

combinations of each of the sizes specified for Type III boxes.

e. Closure. The closure requirements vary for each style of box. Type III boxes are constructed in accordance with Specifications PPP-B-640, PPP-B-1163, and PPP-B-43666. The boxes are closed in accordance with the Appendix of the applicable specification.

f. Strapping Requirements. Either metal or non-metallic strapping may be used to reinforce Type III boxes. Requirements for the size, number, and location of straps vary for each style and size of box. Consult the Appendix of MIL-B-43666 for the detailed requirements for reinforcing the particular style and size of fiberboard consolidation box being used.

7-11. Packing Consolidation Container

a. Problems Involved in Consolidation. The main

problem involved in consolidation of materials becomes one of shock mitigation.

(1) The packer must be skilled in placing packages in the container so that each package "wedges in" other packages.

(2) The packer must be able to block or brace the load as he progresses, in a minimum of time and with the cheapest and lightest material, yet strong enough to do the job.

(3) Essentially, the problem becomes one of converting a type 3 load to a Type 2 load for protection against shock and vibration.

b. Shock Mitigation. In order to meet the problem of shock mitigation relative to consolidation containers, there are certain basic procedures to follow:

(1) Try to maintain level layers.

(2) Fill all internal voids as the load progresses.

(3) Keep the center of gravity low and cen-

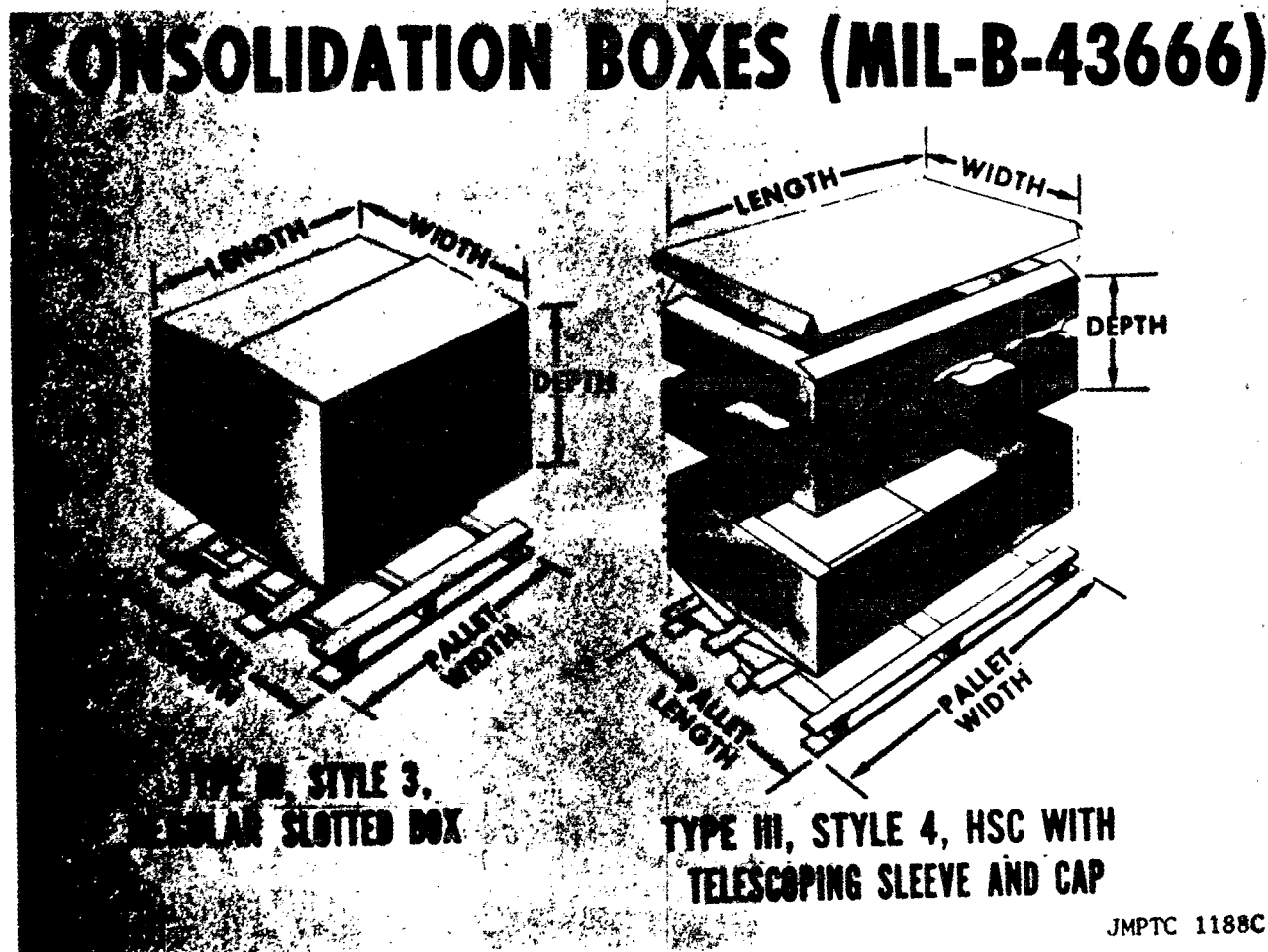
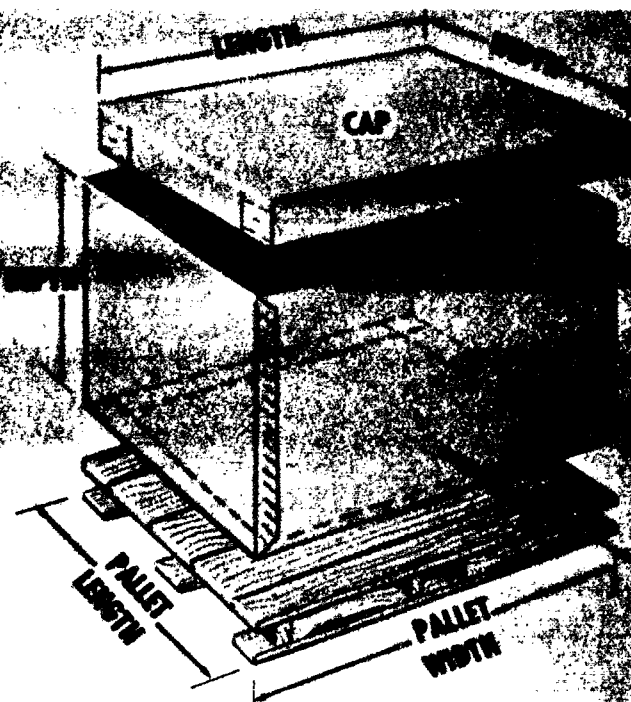
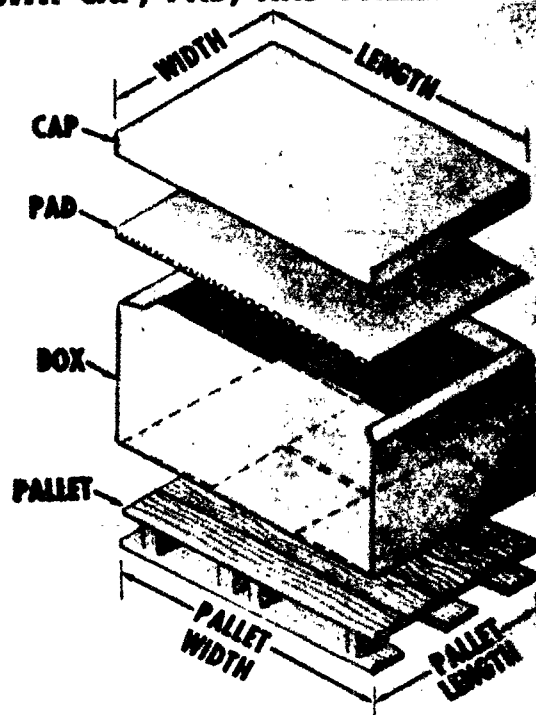


Figure 7-11. Type III, styles 3 and 4, fiberboard consolidation boxes (MIL-B-43666).



TYPE III, STYLE 5, FLANGED BOTTOM FIBERBOARD CONTAINER WITH CAP, PAD, AND PALLET



TYPE III, STYLE 6, HALF SLOTTED CONTAINER WITH CAP AND PALLET BASE

Figure 7-12. Type III, styles 5 and 6, fiberboard consolidation boxes (MIL-B-43666).

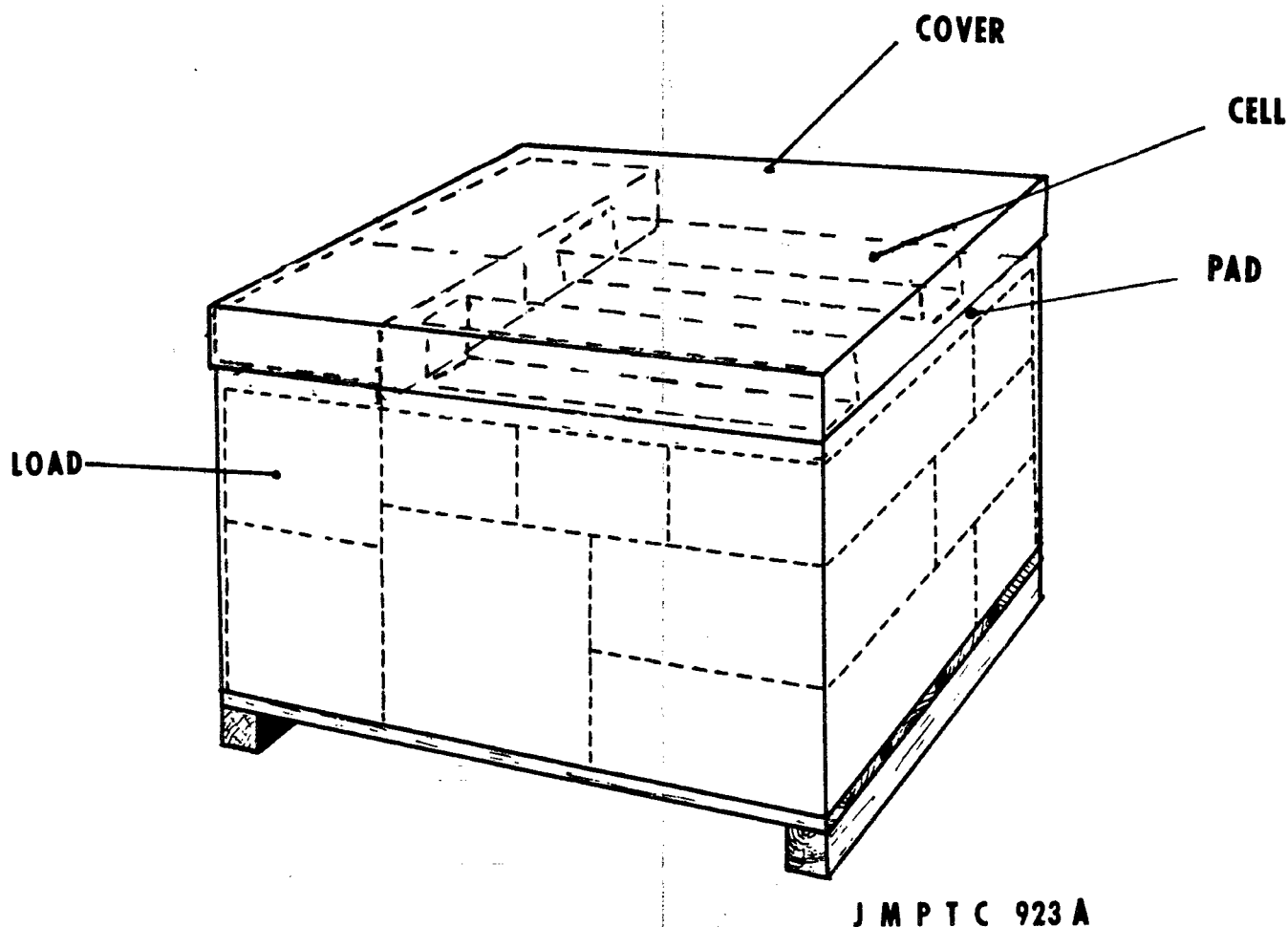


Figure 7-13. Blocking and bracing top voids.

tered by placing heavy items in the bottom portion of the container and centering them in the container as much as possible.

(4) Block and brace the interior load adequately to prevent movement caused by shock and vibration.

c. Blocking and Bracing the Load.

(1) The ideal conditions for full utilization of consolidation containers is to tailor a container to the size of uniform interior packages. Of course, the required consolidation containers are generally of standard dimension and are not related to product package sizes.

(2) These ideal conditions are not always present at the depot or base level, but with a variety of package sizes to place in consolidation containers most of the available space can be utilized in some instances.

(3) Voids that occur at the top of the pack are probably the most usual (fig 7-13). In order to provide holddown media for the load, first cover the packs with pad(s) and then place cells between the pads and the container cover. The use of adhesives will hold the cells in place. Cells should be located where strapping will be placed. Where feasible, the corners of the container may be split down to the top of the load and the excess portion of each side panel, above the top of the load, may be folded in, thus eliminating the need for cells.

(4) Voids that occur at the sides of the pack can be blocked with pads and cells, the same as top blocking and bracing (fig 7-14).

(5) Interior voids (fig 7-15) are the hardest to cope with and the most time-consuming. All voids that would permit shifting of the packages should be filled with cells or foamed-in-place materials as

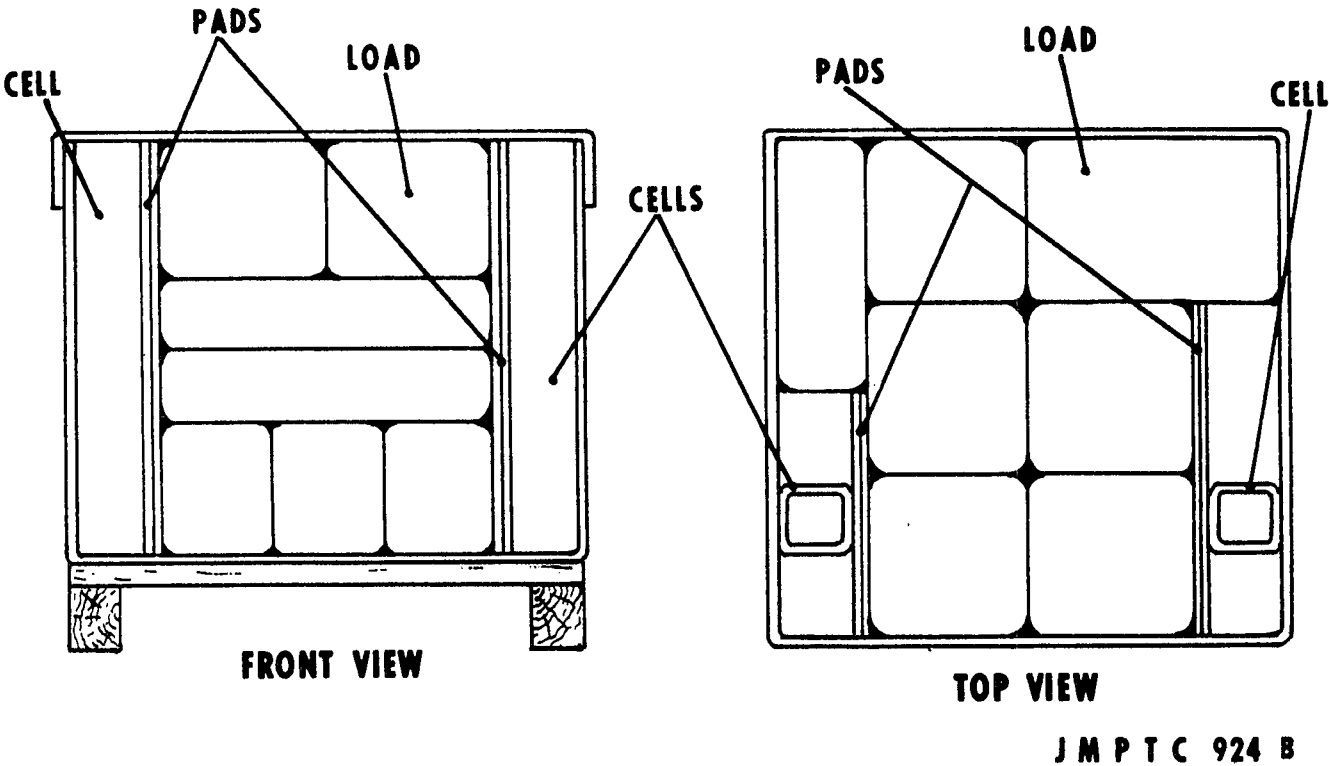
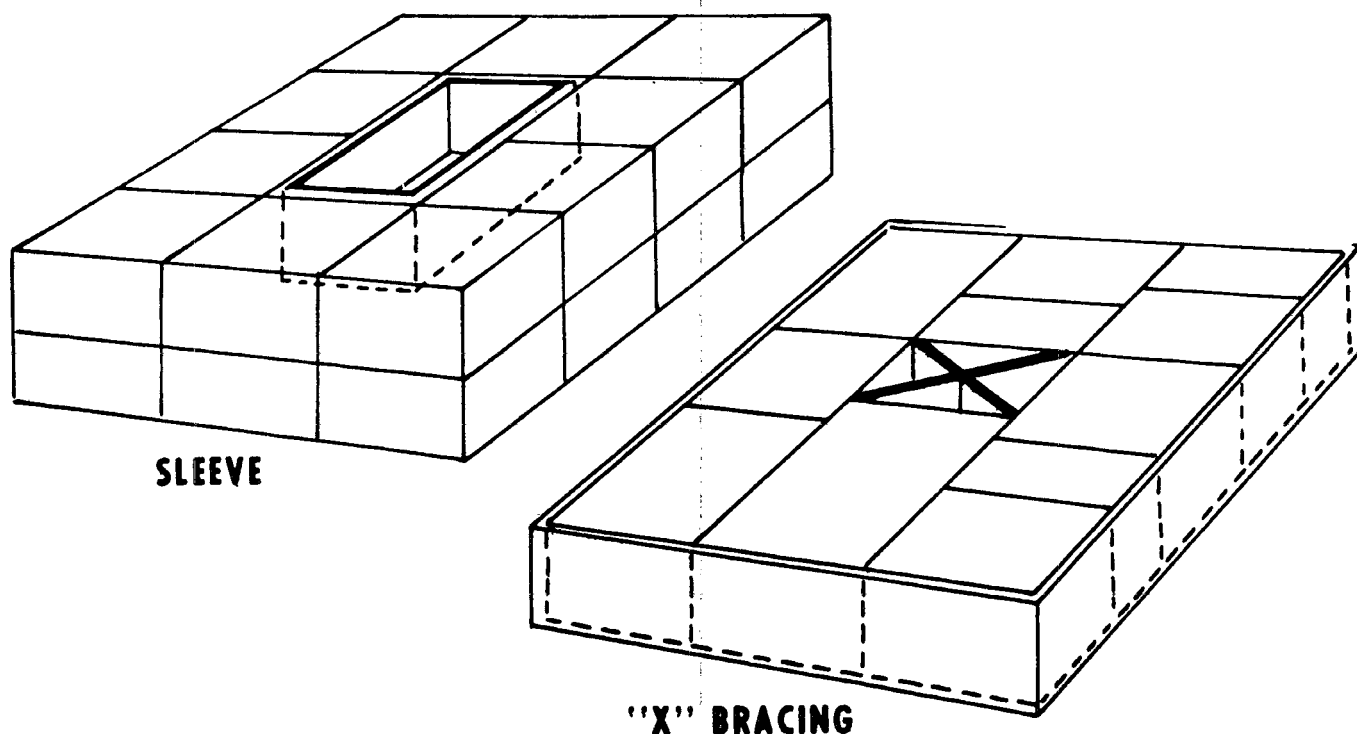


Figure 7-14. Blocking and bracing side voids.



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Figure 7-15. Blocking and bracing interior voids.

the layers progress. If the packages are uniform, one sleeve may fill the void for several layers of packages.

(6) Compound voids (top and side, two sides, etc.) may take a little more skill, but pads and cells can be used to block and brace the same as previously discussed.

7-12. Packing Nonperishable Subsistence Items

Unit loads of nonperishable subsistence items shall be prepared in conformance with Specification MIL-L-35078, Load, Unit: Preparation of

Nonperishable Subsistence. This specification establishes patterns, methods, materials, and techniques applicable to the preparation of unit loads of nonperishable subsistence items by loading the shipping containers onto a pallet or within a consolidation container for shipment. Requirements for establishing unit loads and the selection of unit loads are specified in appendix I of Specification MIL-I-35078. Requirements for supplemental waterproofing of unit loads, which shall be applied when specified by the procuring activity, are specified in appendix II. The types and classes of unit loads are shown in table 7-5, below.

Table 7-5. Classification of Unit Loads of Nonperishable Subsistence Items (MIL-L-35078)

Types	Classes
I—Palletized unit load -----	A—Glued load. B—Glued load with cap and strapping. C—Glued load with sheathing, cap and strapping. D—Strapped load. E—Strapped load with sheathing and cap. F—Strapped load with cap.
II—Containerized unit load -----	A—Triple-wall corrugated fiberboard tube with cap, pad, strapping, and pallet base. B—Solid fiberboard box with liner, cap, strapping, and pallet base. C-1—Wood cleated plywood box with skid base and strapping. C-2—Wirebound plywood box with skid base and strapping. D—Double-wall corrugated fiberboard tube with cap, pad, strapping and pallet base.

7-13. Cargo Containers (General)

a. Definitions.

(1) *Transporter*. A cargo container is a large shipping container in which packed or unpacked materiel is placed for movement to a break-bulk point or to an ultimate consignee.

(2) *CONEX*. The CONEX is a Government-owned noncollapsible, reusable metal shipping container equipped with skids and lifting lugs to facilitate handling.

(3) *MILVAN*. The MILVAN is a Government-owned or leased noncollapsible, reusable cargo container capable of being coupled to another container of like description. It can be lifted by top or bottom corner fittings; can be used either singly or coupled together; and can be carried by highway, rail or water modes of transportation.

(4) *SEAVAN*. A SEAVAN is a privately-owned container of various sizes and configura-

tions which may be leased to the Government for the consolidated movement of materiel by highway, rail, or water modes of transportation.

(5) *Stuffing*. The term "stuffing," as related to cargo containers means the placing of cargo into cargo containers as distinguished from the process of loading containers on board ship. See MTMC Pamphlet No. 55-2 "Management and Stuffing of Containers."

b. Purpose and Advantages of Large Containers.

(1) *Purpose*. The purpose of cargo containers reduce the number of miscellaneous small package shipments to unit loads of the best possible size for the direct application of mechanical handling equipment.

(2) *Advantages*. The use of mechanical handling procedures increases the speed, security, accuracy, flexibility, and economy of supply and transportation operations.

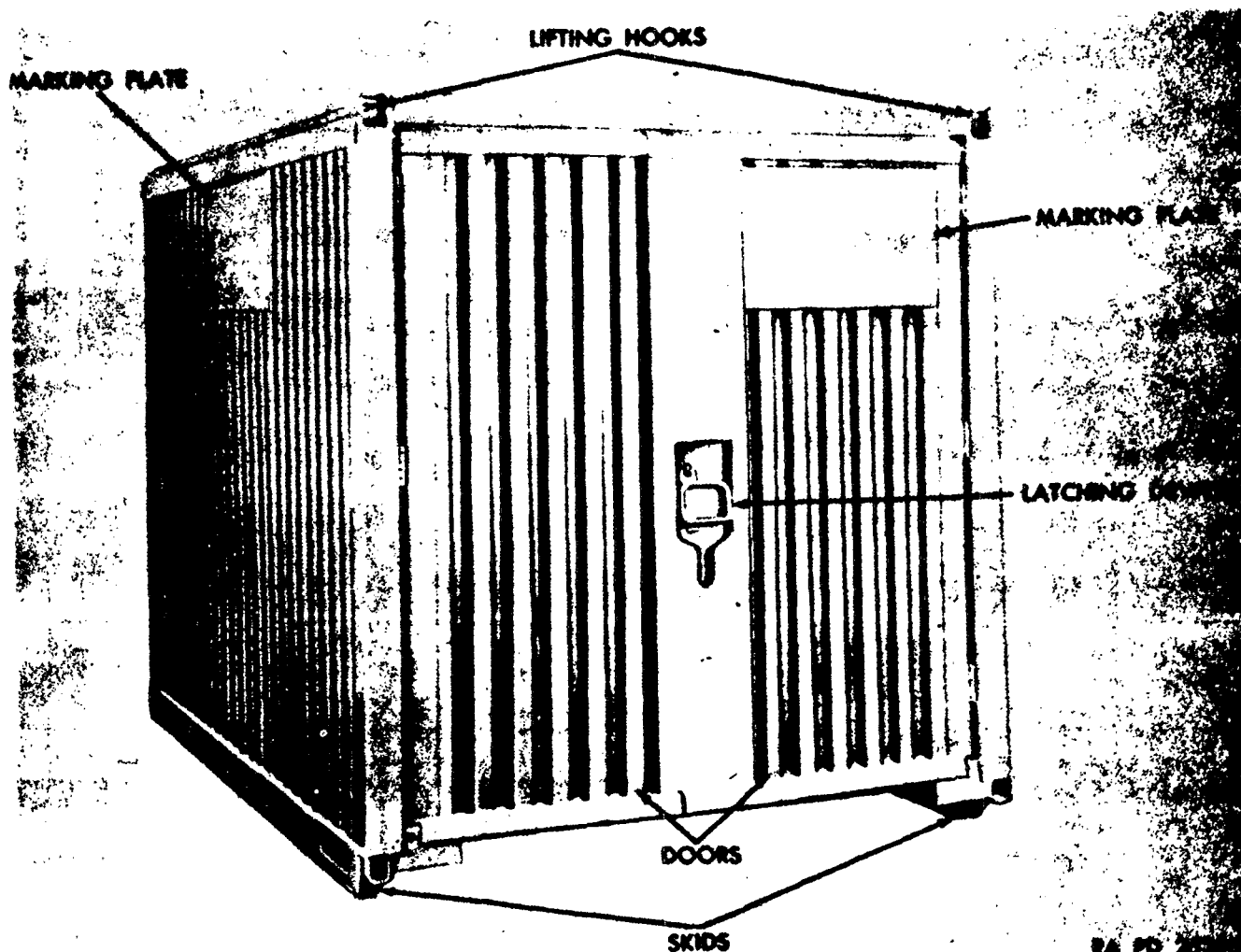


Figure 7-16. Type II CONEX.

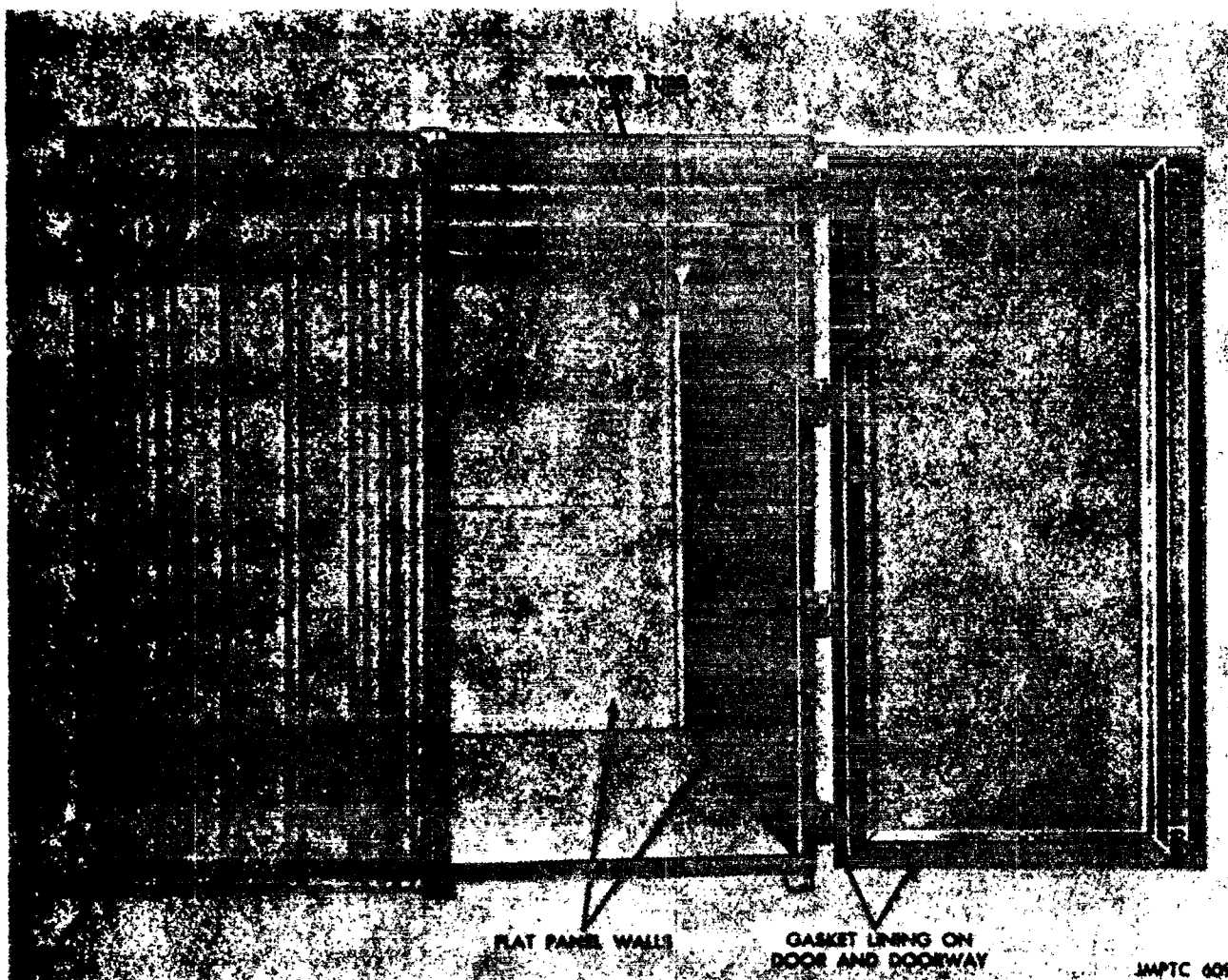


Figure 7-17. Controlled humidity (CH) CONEX.

(a) Use of cargo containers reduces the cost of handling and rehandling many small packages.

(b) Loss due to damage to containers and supplies during handling and shipping is reduced.

(c) Loss due to pilferaging and misplacement or misrouting of individual packs is reduced.

(d) The consolidation of packs within cargo containers reduces the need for marking and documentation of individual packs destined for one consignee.

(e) Savings are realized through the elimination or reduction of heavy or expensive shipping containers.

7-14. Use of CONEX Containers

a. *Description (fig 7-16 and 7-17).* The CONEX cargo containers are reusable metal shipping containers. With the exception of those which are

designed to offer controlled humidity, they are weatherproof but not entirely waterproof. There are two types of CONEX containers.

(1) *Type I (Half-Size).* This type is four feet, 3 inches long and has a volume of 135 cubic feet. It has a weight carrying capacity of 9,000 pounds.

(2) *Type II (Standard Size).* This type is twice as long as the Type I. It has a volume of 295 cubic feet and has a carrying capacity of 9,000 pounds also.

(3) *Type II (Controlled Humidity).* Type II is also available in an airtight type construction which makes it water-vaporproof. It is provided with a free-breathing device which is connected to a desiccant cell. The desiccant cell breathes freely with temperature changes. All air entering or leaving the CONEX must pass through the desiccant, thus maintaining a safe level of relative humidity within the CONEX.

b. Utilization of Weight Capacity.

(1) Items having a density of 30 to 45 pounds per cubic foot should be shipped in a Type II CONEX.

(2) Items having a density of over 45 pounds per cubic foot should be shipped in a Type I CONEX.

(3) The contents of CONEX containers shall not exceed 9,000 pounds.

c. Utilization of Cubic Capacity.

(1) The maximum use of all internal space will normally preclude the use of dunnage. A workable guide is to utilize 80 percent of the usable space.

(2) Unnecessary dunnage adds to the gross weight of the CONEX. Eliminate it when possible.

(3) Large, irregular shaped items should not be stuffed in a CONEX because of the waste of cube.

d. Stuffing of Hazardous Materials

(1) Authorized hazardous materials may be shipped in a CONEX provided they are packed, marked, and stuffed in strict accordance with Department of Transportation and US Coast Guard regulations. Examples of materials prohibited by the US Coast Guard to be shipped in cargo containers alcohol, bombs, detonators, dynamite fuzes, gas projectiles, mortar ammunition, black powder, hand grenades, mines, rocket missiles, etc.

(2) Authorized hazardous materials must be kept separated from the rest of the load.

(3) Noncompatible hazardous materials must be kept separated in shipment.

e. General Rules for Stuffing CONEXES.

(1) *Sensitive and expensive items.* Stuff sensitive and expensive items in the rear of the CONEX to deter pilfering.

(2) *Heavy, rugged items.* Place heavy and more rugged items on the bottom in the CONEX. When necessary, block and brace these items to prevent shifting and damaging other items.

(3) *Sets and assemblies.* Whenever possible keep sets and assemblies together within the CONEX to facilitate keeping them together when the CONEX is unstuffed.

(4) *Items to be shipped to different consignees.* Whenever possible, if items within the CONEX are to be shipped to different consignees, they should be kept together and separated from the rest of the load.

(5) *Priority items.* Whenever possible, plan to load so that priority items will be readily available upon arrival at destination.

(6) *Securing the load.* The load within the CONEX must be secured so that it will not shift in transit.

(a) Place packages within the CONEX so that all available space is utilized. Prevent shifting of containers by cross-tiering, that is alternately fitting them together so that the boxes support each other.

(b) Place dunnage between the load and the sides of the CONEX to fill voids when the containers cannot be fitted snugly.

(c) Block and brace partial loads within the CONEX to prevent shifting by placing 2- by 4-inch lumber across the width of the CONEX, fitting the ends of the braces into the corrugations on the sides of the CONEX.

(d) Use flat steel strapping in the doorway area to prevent the load from spilling out when the CONEX doors are opened. Use two lengths of strapping for each application. Anchor one end of each length by threading the end through a slot in the doorpost, looping the end back against the length of the strap, and securing with a strapping seal. Bring the other two ends of the anchored lengths together at the center of the load, tension the two lengths together, and apply a strapping seal. If strapping is not sufficient to secure the load, fill the intervening spaces between the straps by placing additional strips of wood dunnage vertically or horizontally beneath the straps prior to tensioning the strapping.

f. Closure and Sealing.

(1) *Weatherproofing the doorway area.* Since the CONEX is not completely waterproof, secure waterproof barrier material in the doorway area when there is a danger that water may damage the contents in the CONEX.

(2) *Placing the shipping documents within the CONEX.* Place the shipping documents in a shipping document envelope and place the envelope in the packet located in the CONEX door, so that it is easily accessible when the CONEX is opened.

(3) *Closing the CONEX doors and securing the handle.*

(a) Close the CONEX doors and lock them in the closed position by turning the door handle 90° so that the hole in the handle is in line with the hole in the bracket which is located on the CONEX door.

(b) Secure the door handle with zero to five gage wire. Pass the wire through the holes in the door handle and the door bracket. Thread the wire through two holes drilled an inch apart in an 18-to-20-inch steel bar. Twist the bar several times.

MILVANS COUPLED FOR TRANSPORT

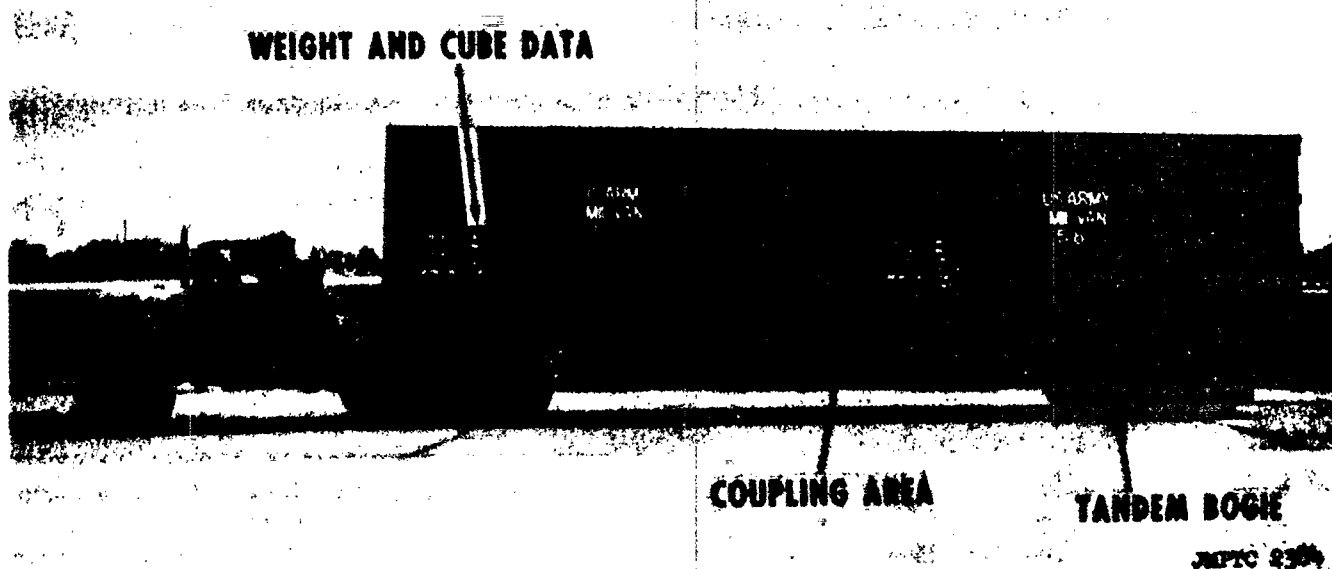


Figure 7-18. MILVAN cargo containers.

remove the bar, and cut off the surplus wire close to the twist with a bolt cutter.

(c) A padlock may be used in lieu of the wire when authorized. Care must be taken to insure that the consignee has the means to open the lock upon arrival.

(4) *Applying the seal to the door handle.*

(a) Make sure that the serial number on the seal corresponds with the number recorded on the shipping document.

(b) Thread a standard railway car seal through the slot in the door handle and the slot in the bracket which is located on the CONEX door.

(c) Thread one end of the seal into the locking device on the seal and snap into place.

g. Marking.

(1) *Location of markings.* Exterior marking plates are located on each side and on the front and rear of the CONEX. Address markings will appear only on these plates.

(2) *Obliterating old markings.* Obliterate old markings on the marking plates by repainting them.

(3) *Requirements for marking.* Markings on CONEXES must conform to MIL-STD-129, and to MILSTAMP/MILSTRIP requirements.

(4) *Applying the markings.* Apply the markings on the address plates in colors which contrast with the background, so that they can be read easily from a distance.

7-15. Use of MILVANS and SEAVANS

a. Description of MILVAN (fig 7-18). A MILVAN has inside dimensions of 231 inches in length, 92 inches in width, and 87 inches in height. The gross weight rating for each 20-foot container is 44,800 pounds. A MILVAN can be coupled to another MILVAN container to make a single unit 40 feet in length. A MILVAN has the capability of being moved by a semitrailer tractor when used in conjunction with a tandem bogie arrangement which serves as the rear wheels. When the double doors are properly closed, the MILVAN affords waterproof protection.

b. Description of SEAVAN (fig 7-19). SEAVANS vary from approximately 20 to 40 feet in length. The standard length utilized by the military is 40 feet. SEAVANS are 8 feet in height and 8 feet in width. They have a maximum gross weight capacity of 67,200 pounds. SEAVANS are compatible for movement by motor and rail and may be stored for shipment on specially containerized ships. They may be transported on a semitrailer

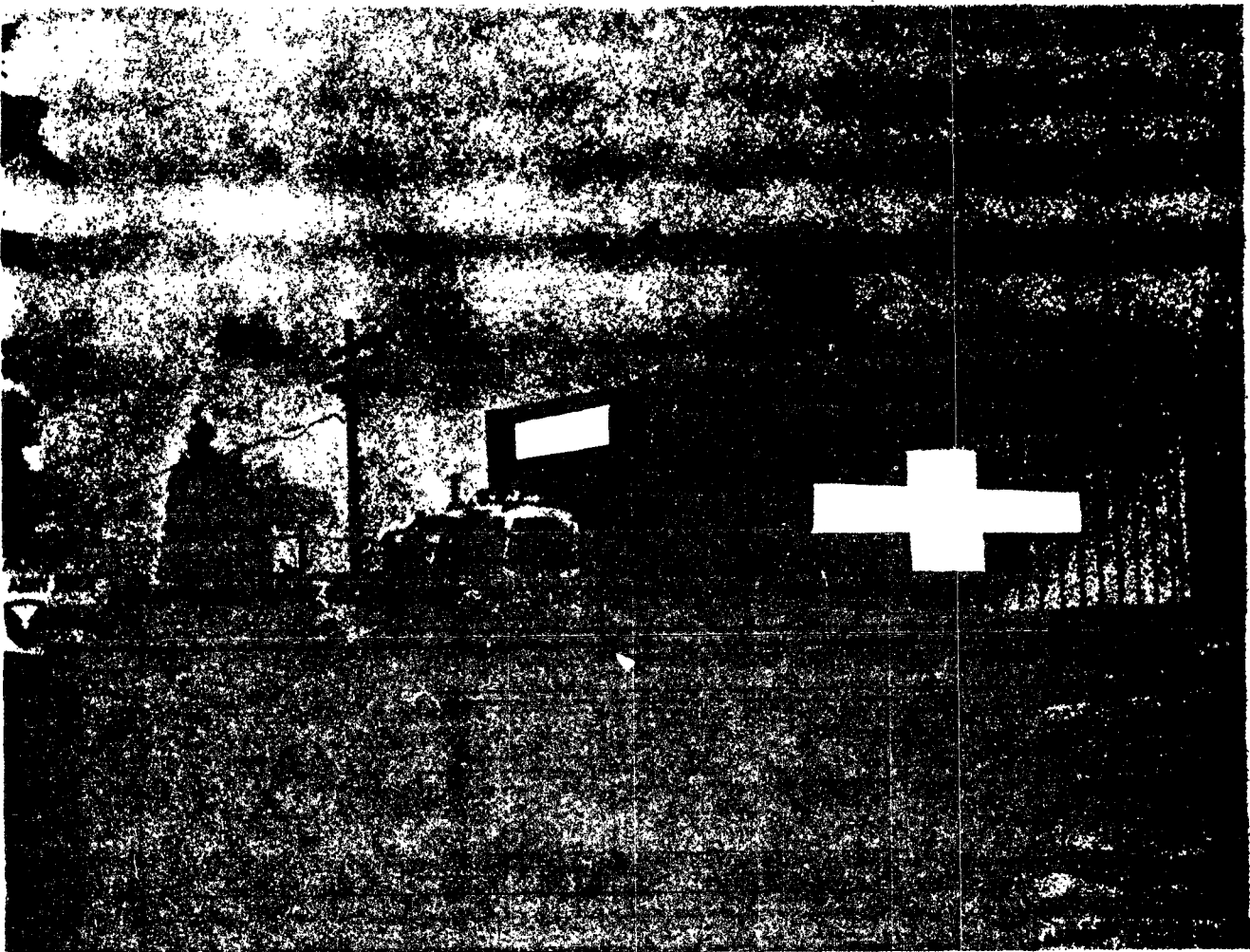


Figure 7-19. SEAVAN loaded for highway movement.

chassis and are lifted easily and loaded, minus the chassis, on board by modern materials-handling equipment. There are four general types and three specialized types of SEAVANS:

(1) *Dry cargo container.* The dry cargo container is weatherproof and is designed to protect the cargo from water. It is ideally suited for shipping items packed in domestic packs and any commodities susceptible to water damage. The dry cargo container is completely inclosed and must be loaded and unloaded by hand or forklift truck.

(2) *Dry cargo—canvas top container.* The canvas, or so-called "rag" top container, is similar to the dry cargo container, but has a removable canvas top. With the top removed, the cargo can be loaded and unloaded by crane as well as forklift. Canvas top containers are not 100 percent weatherproof; therefore, all items loaded in such containers must be in waterproof packs or otherwise not be susceptible to water damage.

(3) *Flatrack container.* The flatrack container resembles a flatbed truck with varying styles of side bracing and corner posts. Generally, the flat rack has about two-thirds the cubic capacity of a dry cargo container, but with the same weight capacity. It is designed to carry high density and oddly shaped cargo that requires little protection against the elements. Brackets on the sides of the bed facilitate efficient tiedown or banding of heavy items to the bed of the container. Open sides and ends facilitate the loading and unloading by crane or forklift truck.

(4) *Reefer (refrigerator) container.* Perishable cargo that must be refrigerated or frozen must be transported in a reefer. Most of the commercial reefers have standard refrigeration units that are fuel operated for road use and electrically operated for storage or ocean transit. The standard container can refrigerate or freeze from ambient temperature to -10 degree Fahrenheit.

(5) *Insulated container.* This is a specialized container. It is used for cargo that should not be subjected to rapid temperature changes. It should be used when extreme changes in ambient temperatures are indicated.

(6) *Car-carrier.* This specialized container is designed to carry two or four privately-owned vehicles for ocean transportation. The container which carries four vehicles is 35 feet long and has double-deck frames. Due to its additional height, the four vehicle container has one and one-half times the cube capacity of a dry cargo container.

(7) *Tank container.* This also is a specialized container. It is a small tank, inclosed in a framework, that can be used for small lot shipments of bulk liquids.

c. Weight Distribution.

(1) Distribute the load evenly throughout the container with heavier items on the bottom.

(2) Cargo must be compatible with the size of the container. When the density of one commodity is not compatible with the container size, select an adequate commodity mix that will yield the best cube utilization. At least 80 percent of the cube should be used.

d. Weight Limitations. There are two overall transporter-weight limitations: First, the rated capacity of MILVANS and SEAVANS; and second, the road-weight limitation imposed by the States over which the container must travel by motor vehicle.

e. Shipment of Hazardous Materials.

(1) Hazardous materials must be compatible with the remainder of the load. Do not stuff food or medical supplies in the same container as insecticides, chemical products, radioactive materials, biological materials, poisons, or toxic materials.

(2) Do not ship noncompatible hazardous materials together.

(3) Pack, mark, label, and placard hazardous materials in strict accordance with Department of Transportation and US Coast Guard regulations.

(4) The US Coast Guard regulations prohibit certain explosives and other hazardous materials from being shipped in cargo containers. These include, but are not limited to, those mentioned in discussing the stuffing of CONEXES.

f. General Rules for Stuffing MILVANS and Seavans. The general rules discussed below concern the stuffing of general cargo into MILVANS and dry cargo type SEAVANS.

(1) Place heavy items on the bottom of the

load, maintaining an even distribution of weight throughout the cargo container.

(2) When stuffing standard 43-inch high modular containers, double-tier them whenever possible. If double-tiering is not possible, top off the load with "fluff cargo" of low density. "Fluff cargo," which must be man-handled, should not exceed 200 pounds per item or pack.

(3) Leave several inches of head space between the top of the load and the top of the cargo container that the load can be removed easily with a forklift truck.

(4) Pack the load as tightly as practicable. Do not wedge the load or pack it so tightly that problems will occur during unstuffing operations.

(5) Always position palletized or skidded loads to rest on their pallets or skids. Face pallet access slots toward the doors to minimize forklift maneuvering during unstuffing operations.

(6) Never place a heavy crate or box so that it rests on top of, and inside the four corners of the box beneath it. Place dunnage over the lower level of containers when dense loads in the upper tier may cause damage to the containers below.

(7) Place boxes, crates, and cartons, which contain liquids that may leak, on the bottom of the load whenever practicable.

(8) Keep drums that contain petroleum products separated from general cargo. Stow drums with their bungs on top. Pack the drums tightly. When possible, palletize drums. When not palletized, place strips of dunnage between tiers of drums.

(9) Use lumber, burlap, fiberboard or paper, as applicable, to protect the cargo and to prevent it from shifting during transit. Use dunnage when it is available for filling spacing between large boxes or crates.

(10) A load checker should keep a running account of the weight of individual items being stuffed to ensure the correct total net weight. Enter the overall load weight and cube on the loading list or the Transportation Control Movement Document (TCMD).

(11) Brace cargo of average or high density to prevent it from falling out when the container doors are opened.

g. Closing and Sealing MILVANS and Seavans. Place the shipping documents in the space provided on the door. Make sure that both rear doors on MILVANS and SEAVANS are closed by sliding the closure bolts into the holes provided in the body of the cargo containers. Position the door handles over the latches in the doors and

attach a numbered railway car seal. MILVANS require that both door latches are provided with a seal.

(1) Make sure that the serial numbers on the seals correspond with the numbers on the shipping documents.

(2) Thread the seals through the latches on the doors and snap the seals into the seal locking devices.

(3) Use padlocks of approved design on cargo container containing classified material. Be sure that key control measures are provided.

h. Marking of MILVANS and SEAVANS. Shipment units and shipment units in consolidation will be address marked in accordance with Military Standard MIL-STD-129, Marking for Shipment and Storage. The address markings for MILVANS and SEAVANS shall be accomplished by attaching a waterproofed Military Shipping Tag (DD Form 1387-1) adjacent to the seal, if required, or at the rear of the van. Data for the tag will be in conformance with DOD 4500.32R, Military Standard Transportation and Movement Procedures (MILSTAMP) and MIL-STD-129.

APPENDIX

NATIONAL STOCK NUMBERS

1. General

The selection of the proper items of supply for use in military preservation, and packing operations is of vital importance. This selection must be made in accordance with requirements established on commodity and process specifications and other official publications. Items of supply are designated by name, type, class, style, grade, size, color, length, width, etc. The difference of an item in any of these respects from any other item, establishes it as a separate and distinct item of supply. These distinct items must be used as specified to properly perform preservation and packing processes and methods. To make proper selection possible, the Federal catalog system is designed to classify, describe and assign one, and only one, National stock number to each item of supply. The listing of classifications, descriptions and National stock numbers for the hundreds of items used in preservation and packing, and appearing in the Federal supply catalog is beyond the scope of this manual. The purposes of this appendix is to emphasize the importance of stock numbers in the military supply system and to furnish general information concerning their structure and use.

2. Composition of the National Stock Number

The National stock number (NSN) is composed uniformly of 13 digits and is always written in a 4-2-3-4 format. The first four digits (8105) are the Federal Supply Classification Code (FSC) and the last nine digits (00-290-0345) are the National Item Identification Number (NIIN). The whole National stock number is never separated to run into a second line.

a. Federal Supply Classification. The Federal supply classification is used to classify items of supply identified in the Federal catalog system. It is designed to include all items known to be in the supply system of the Federal Government. Of the four digit code (8105) used to identify Federal

supply classifications, the first two digits identify the broad *Group* of material. Group 81 covers containers, packaging, and packing supplies, and the last two digits identify a particular *Class* within the group. Class 05 covers bags and sacks. Other examples of Federal supply classifications are as follows:

FSC	Group	Class
	55	30
5530 ----	(Lumber, millwork, plywood, and veneer.)	(Plywood and veneer).
	81	(15)
8115 ----	(Containers, packaging and packing supplies.)	(Boxes, cartons and crates).

b. National Item Identification Number. The last nine digits of the National stock number comprise the National Item Identification Number. This number serves to differentiate each item of supply from all others within its *Class*. In the example above, the NIIN 00-290-0345 identifies a 9 1/2 x 14 1/2 paper cushioned shipping sack, conforming to sacks in the 05 *Class*. Each item of supply has one, and only one, National item identification number, and each National item identification number applies to one, and only one, item of supply. The National item identification numbers are assigned serially without regard to the name of the item, its description, or its classification. The National Codification Bureau code (NCB) is represented by the first two digits in the NIIN.

3. Breakdown of the National Stock Number

a. For clarification purposes the following is a breakdown of another National stock number related to a common packing material.

FSC	NIIN
8 1 1 5-	00-753-4691
	NCB Code

GROUP 81 Packaging and Packing Supplies.)	CLASS 15 (Boxes, Cartons and Crates.)	ITEM 00-753- 4691 Fiberboard, Triple-Wall, PPP-B-640, length 58 inches, width 35-7/8 in., depth 28- 1/2 in.).
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b. The NSN is part of the NATO numbering system. The US will use 00 and 01 for the first 2 digits of the NIIN.

c. If the first 4 digits are followed by 00 the number is a former FSN. If the first 4 digits are followed by 01 the number indicated a new item.

4. Use of National Stock Numbers

Items of supply for use in preservation and packing operations are of wide range and appear under several classification codes. These codes cover cleaning materials, preservatives, barriers, tapes, adhesives, cushioning materials, various types of equipment, marking materials, fasteners, interior containers, exterior containers, and many other groups and classes. Oftentimes, there are several classifications covering general groups of

items. National stock numbers are assigned to each specific item under each classification in accordance with item name and specific characteristics. When selecting items and materials which meet the requirements of preservation and packing specifications and directives, identification is accomplished by reference to titles and descriptions appearing in the Federal supply catalog. The following are representative examples:

National Stock No.	Description
8135-00-171-1559	<i>Barrier Material, Water-proofed, Flexible:</i> components and wt per 500 24-by 36-in. sheets, paper 30 lb. asphalt 50 lb, paper 30 lb; 200 yd roll, Fed PP-B-1055, class C-1; for interior wraps.
8135-00-558-0823	<i>Cushioning Material, Packaging:</i> cellulose wadding; water-resistant; low absorbency; 66 ft. long, 20 in. wide, 1 in. thick; Specification PPP-C-843, type II, class B.

5. Sources of National Stock Numbers

National stock numbers are listed in Federal supply catalogs published by the Defense Logistics Agency. Stores stock catalogs published by General Services Administration contain numbers and descriptions of items handled by this agency. Federal and military commodity specifications indicate Federal supply classification codes only.

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